RAILWAY ENGINEERING AND MAINTENANCE OF WAY.

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CONTENTS.

Selection of Staff Officers.

THE high motive power or engineering official is not always a technical man. Whether or not he is technically educated, however, he appreciates the necessity of technical talent in the operation of his department of railway operation. Otherwise he would not be broadminded enough for the responsibility of the position. The policy of selecting as advisers, men who are qualified to supply with their variously specialized educations that which is lacking in the brain of the head officer is the one adopted by the successful mechanical or engineering official.

Frequently in railway operation, as in other industrial pursuits, a petty officer attempts to so organize and maintain his force as to concede no knowledge superior to his own no matter how much in detail is the matter under consideration. If a man demonstrates superior abilities, due to specialization, to such an officer he is forthwith squelched and must retire if he is to retain his self respect. This kind of an organization cannot cope with problems beyond the comprehension of the single man in charge and as a result he cannot attain or, having attained, remain long in charge of a department of which large things are expected. This policy in effect is the same as that which would not allow of the use of a dictionary in any literary work. It is a short sighted attempt at preventing the other fellow from sliding into prominence and perhaps succession to the job of the superior. Needless to say this kind of an officer most often finds himself displaced on account of his drastically preventative tactics.

The broad-gauged man who, as the head of a large department, surrounds himself with a staff each member of which is qualified to offer acceptable advice with respect to certain phases of the work undertaken is the only type of officer who should properly be slated for promotion and who after promotion to the highest office is himself qualified to hold it. The surest policy for attaining real success in administrating is that which directs the obtaining of the very best talent in assistants within the limitations of the salary appropriations. The results which follow on account of individual competency in the personnel of the staff are sure to reflect credit upon the department chief who will thus prove himself too valuable a man to be displaced by one of those whose services he has engaged.

Fair Treatment for the Engineer.

ON another page of this issue we publish some pages from "The Engineer's Distress," reproduced from the original tracings. These pages deal in a humorous way with reductions in a railway engineering department during and after the 1907 panic.

The loss of a position at such times, not on account of unsatisfactory service, but on account of curtailment of expenses, is serious rather than humorous. The practice is all too common. The engineer is expected to put in from 10 to 16 or 18 hours work on location or construction jobs. What are the feelings of a faithful employe when after a summer of strenuous work, he is layed off on the approach of cold weather, or on account of a slump in the stock market? Such a policy is a serious hindrance to the increase of efficiency, which is being so radically advocated in railway work. However, leaving out all questions as to the effect on the railway itself, a feeling of humanity and consideration should dictate

an opposite policy. A faithful and efficient employe should never be discharged without cause.

An engineer who has climbed far enough up the ladder to be termed an "employer" rather than "employe," recently stated that he had not a single instrument man who had any experience whatever. Another says that it is impossible to obtain the amount and quality of field work and brain work from engineers as formerly because they know and are not backward in stating the fact that it is useless to put in their best licks for they will probably be dismissed when work becomes slack.

A good many mistakes have undoubtedly been erroneously charged to our railway engineers, due to the jealousy among the different railway departments. We must admit, however, the engineers do make mistakes involving thousands of dollars, which we believe could be largely eliminated were an experienced and competent man in charge of the party. Thus it would seem that a railway could keep its experienced men, giving them permanent positions, and lose very little in the aggregate. Such a policy would tend to restore the old feeling of loyalty among employes, one of the first results of which would probably be the increased economy which so many railways are now trying to attain by appeals to their employes.

AN INTERSTATE LABOR COMMISSION.

Editor Railway Engineering: I have read with a good deal of interest your editorial on the subject of regulation of labor unions of transportation employes. I think the suggestions worthy of very serious consideration. I believe the public, having secured regulation of transportation charges, are now more interested in securing proper and regular service, and certainly the disruption of railway service is a more serious matter to all of the public than the question of charges for service, because the stoppage of railway traffic affects directly, or indirectly, all of the public while the charges for traffic really affect only a very people.

(Signed) H. U. Mudge,
Pres., C., R. I. & P. Ry.

Editor Railway Engineering: Noting an article in Railway Engineering entitled "An Interstate Labor Commission," I would like to offer a few criticisms.

Passing by the writer's comments on the powers of the Interstate Commerce Commission, etc., we will take up for consideration the statement that "the railway world, and indeed the whole industrial world, is now confronted with the organization of labor trusts which are not responsible to the law, to its employers or to the public, while they hold in their hands the power to disrupt all of the structures of the public."

The statement that the labor organizations are not responsible to the law seems a rather broad assertion. I would respectfully ask in what way are they not responsible to the law. The labor organizations have for sale their labor. They may demand unreasonable prices or reasonable prices as the case may be, but the corporations are by no law of the land bound to accept their propositions. Each individual member is responsible to the law morally, socially and otherwise, the same as though he were not a member of a labor organization, just as each individual member of a corporation is responsible to the law. The whole question then, regarding the organization of labor, is making better the conditions and environments of the laborer, and the prime factor in this move is to get better wages. In other words selling his labor at the highest possible figure, and it depends entirely on the well understood and recognized principle of supply and demand—which principle is employed by all merchants and manufacturers. It might be argued that the labor organizations set their price or demands on the product or labor of the whole membership, and that the employer is compelled to accept the proposition as a whole without discrimination. As a counter argument to this it could reasonably be asked, would a merchant or manufacturer dismember his products or machine and sell a portion of it at the same proportionate price as he would sell the whole, running the risk of dispensing with the remainder at its proportionate price?

The writer states that "A railway cannot increase its own wages (rates) except with the freely obtained consent of its employers (the public)."

The question then arises, who are the public? Statistics I believe will show that about one-fifteenth of our population are railway employees, or are engaged in conducting transportation. One could go farther and say that anyone transporting by steam boat, wagon or other means is in the same vocation. My object is here to show that the railway employees are a considerable portion of the so-called public, and all those who are conducting transportation could not be seriously affected by raising freight rates unless the rates were raised so high that it no longer was profitable for the shipper to ship, thereby throwing the transportation companies out of employment. I believe the railway managers are far seeing enough to prevent a condition of this kind. It has been my experience that the railway companies are trying to encourage shipments and build up the country. It would seem illogical for them to do anything else.

Referring again to the restricting of railway rates, I believe that a railway company has the same moral right to hold its rates up to the point where a fair percentage can be made on its investments as any merchant or manufacturer, and a railway company stands in the same danger of competition as does any one engaged in any other line of business. To boil the whole thing down it would appear that the so-called public have clamored for a reduction of rates, until the railway companies can no longer keep up their maintenance of way or rolling stock to that standard which they previously did, and the so-called public now comes along and insinuates that they should cut down the wages of their employees.

Would it not be well to have a commission appointed to enter the factories of this country, for the purpose of regulating the prices of their products? For the merchant and manufacturer are as much public servants as are railway companies. It is of more consequence to eat than to ride. As a primary proposition, most any locality will sustain its population without railways, but not without that which the merchant controls. It would not take a far seeing business man to arrive at the conclusion that the cheaper he could get his wares transported from New York to the Antipodes, the more profit he could make on them.

(Signed) H. L. Bartels, Parkersburg, W. Va.

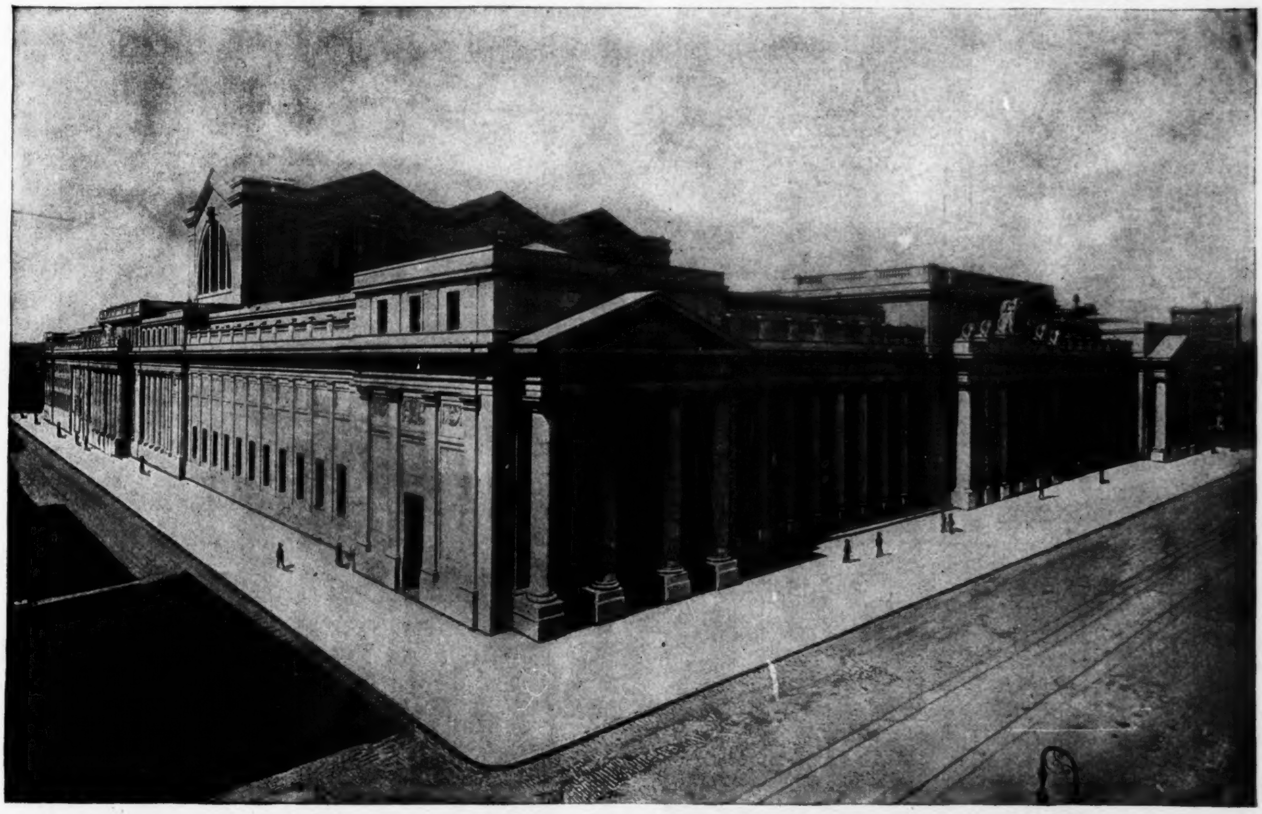
Corrosion of rails exposed to tunnel gases has been found to reduce the life materially in the case of the long tunnel at Sand Patch, Pa., on the Baltimore & Ohio Railroad. This tunnel is 4,775 ft. long, and is operated with double-track traffic on a single-track line. The interior condition is one of practically continual dampness, with locomotive gases present. Plain Bessemer rails have a life of about 18 months in the tunnel. Deterioration proceeds in the flaking of a scale from the rail until the edges of the base become quite sharp and removal is necessary. Chrome alloy rails, substituted for the Bessemer rail at the last renewal, have now been in service nearly three years. In addition to the increased length of life resulting from the ability to resist corrosion, the breakages in this latter class of rail have been less than one-fourth of the number for the plain rail, according to Mr. M. J. Corrigan, general inspector of tunnels of that road.

New York Tunnel Extension, Pennsylvania R. R.*

Briefly described, the New York tunnel extension begins at Harrison, N. J., a short distance east of Newark, where is located the yard for the electric locomotives used in the tunnel. Passenger trains from western and southern points change here from steam to electric power. Passengers whose destination is in the downtown district of New York alight and walk across the transfer platform to an electric train running into the Church and Cortlandt Street station of the Hudson & Manhattan R. R. This downtown electric train starts from an underground station in Newark, passing over a new bridge spanning the Passaic river at Centre street, to Harrison, where passengers transfer to trains for the Pennsylvania station uptown or go to Jersey Ctiy and lower New York. Through trains from New York leave Harrison on rails crossing over the old Pennsylvania tracks on a steel and concrete bridge. A double track line extends across the Hackensack Meadows to Bergen Hill. At this hill, which is a continuation of the rocky cliffs extending along the Hudson river, are the entrances to the tunnels which lead under the North river and into the station in New York and thence on to Long Island City.

To carry out this great tunnel enterprise the engineering talent of the world was drawn upon, and the work was successfully prosecuted under the masterly supervision of Mr. Samuel Rea, second vice-president of the Pennsylvania R. R., with whom President Cassatt planned from the beginning.

A summary of the tunnel plants as outlined by the late Mr. Cassatt to the Board of Rapid Transit Railroad Commissioners of New York City, described the Pennsylvania Tunnel & Terminal R. R., generally referred to as the New York tunnel extension of the Pennsylvania R. R., as the line beginning near Newark, N. J., crossing the Hackensack Meadows, passing through Bergen Hill and under the North river, the Borough of Manhattan and the East river to the large terminal yard known as Sunnyside Yard in Long Island City, Borough of Queens, New York. The project included the electrification of the Long Island R. R. within the city limits and the electrification of the United R. R. of New Jersey division from Newark to Jersey City. At that time the estimated cost of the improvements was $159,000,000. New charters and franchises had to be obtained to inagurate the work.

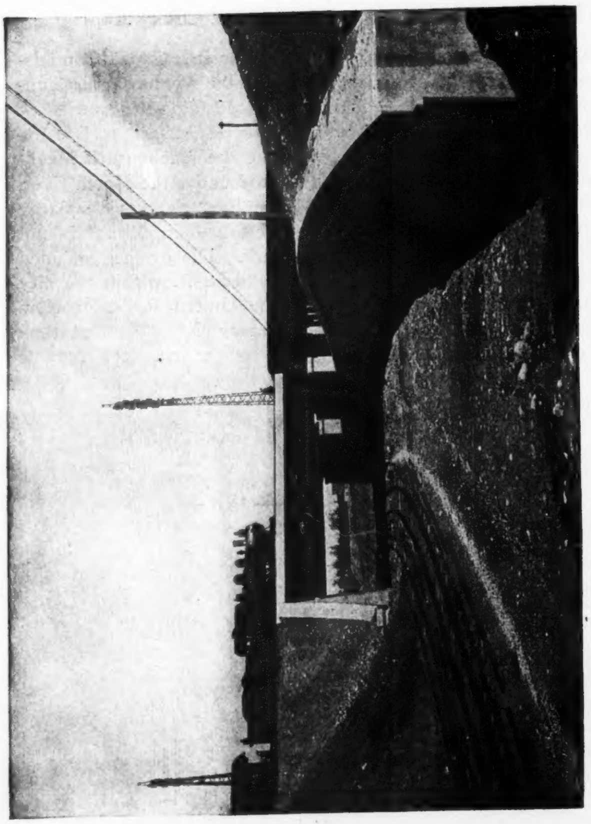


Pennsylvania Terminal Station, New York.

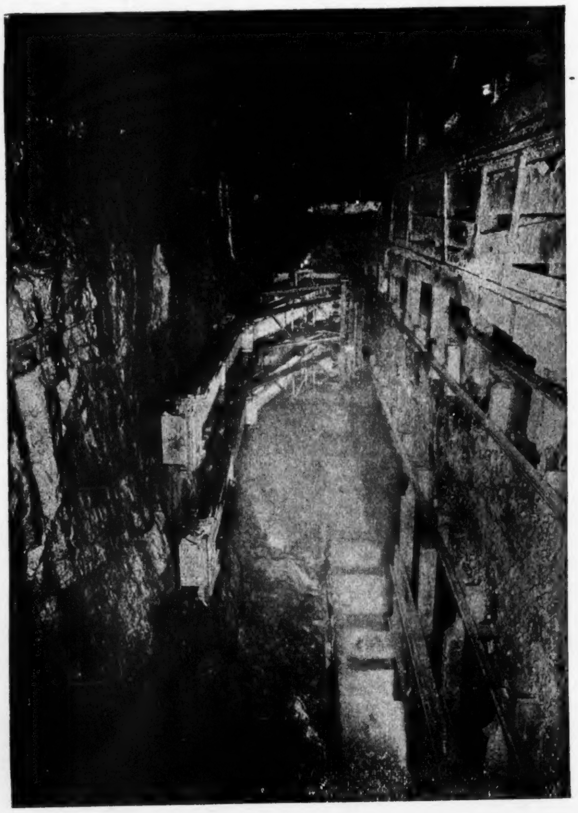
A board of engineers was organized in January, 1902, and Vice-President Rea had general charge of all matters involved in the designing and execution of the project.

The great tunnels extending the line under the North and East rivers were the novel features of the project. Tunnels of this character had never been attempted. It was desired to make them as straight as possible and sufficiently deep to insure them against possible injury from heavy anchors or sunken vessels. They had to pass under piers and bulkheads at sufficient depth not to affect the stability of those structures. The line from Bergen Hill west had to be established so as to give ample head room at the numerous bridges over the railroads and highways which it crosses. The character of the material through which the tunnels were to be constructed differed greatly in the two rivers. The bed of the North river consists of silt, composed principally of clay,

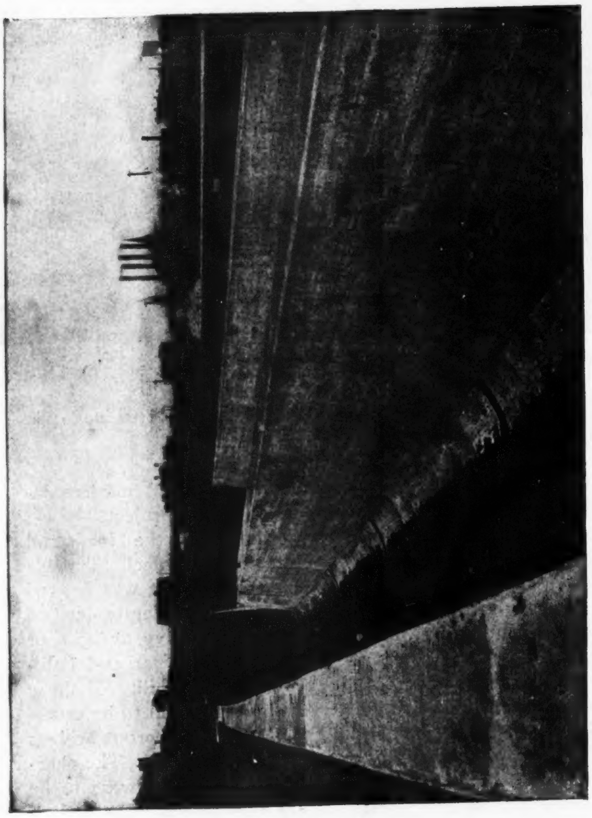
*We are indebted to the American Cement Company, Philadelphia, for the data, and to the Cement Age for the illustrations, in this article.



Retaining Wall at Sunnyside Yard Loop.



Conveyor Used for Distributing Concrete.



Concrete Retaining Walls, Entrance to Tubes A and C. Sunnyside Yard.

Concrete Construction Near Portal, East Avenue Shaft.

sand and water, while that of the East river is formed of a great variety of materials, including quicksand, sand, boulders, gravel, clay and bed rock. There were no satisfactory precedents to follow, and the Board considered methods from all available sources. It was finally decided to adopt the shield method with compressed air for the tunnels under both rivers. It was found extremely difficult to construct the tunnels in such material as was found in the East river and on the New Jersey side of the North river.

Design of the Sub-River Tunnels.

The sub-river tunnels consist of a circular cast iron shell of the segmental, bolted type, having an outside diameter of 23 feet, lined with concrete of a normal thickness of 2 feet from the outside of the shell. Through each plate of the shell there is a small hole closed with a screw plug through which grout may be forced into the surrounding material. Each tunnel contains a single track. A concrete bench, the upper side of which is 1 foot below the axis of the tunnel, is placed on each side of the track, the distance between benches being 11 feet 8 inches. These benches contain ducts for carrying electric cables. A double bore with single tracks was adopted to avoid accidents, and the tunnels are made just large enough to allow the passage of a train with perfect safety. It was believed that ventilation would be secured by the motion of the trains, but nevertheless a complete ventilating plant was provided for each tunnel.

The concrete lining was introduced to insure the permanency of the structure, strengthen it from outward pressure and guard against injury from accidents which might occur in the tunnel. The side concrete benches were suggested by President Cassatt to confine the trains to the center of the tunnels in case of derailment, and to serve the further purpose of sidewalks. Refuge niches are constructed in the side benches of the tunnels. Manholes, splicing chambers, pump chambers, and other features for the handling of electric cables and drainage were established at intervals. In the North river tunnels the concrete lining in the invert and in the arch was reinforced by longitudinal steel bars. Owing to the character of the material to be passed through, the tunnels under the East river were the most difficult and expensive section of that division, and the plant assembled by the contractors is believed to be the most extensive ever placed on a single piece of work.

Placing Concrete Lining, East River Tunnels.

The Bergen Hill Tunnels.

At Bergen Hill, which forms the lower extension of the Hudson River Palisades, there are two parallel single track tunnels. These tunnels were excavated entirely by the center top heading method. Where no timbering was required, several different methods were used in drilling and excavating the solid rock. All the trap was stored to be used later for concrete and ballast. The concrete lining was started at both ends of the tunnels before the headings were finally holed through, so that there was practically a separate organization at each end. The concrete was first placed in the foundations up to the elevation of the bottom of the conduit bins, this work being kept well in advance. Next followed, in the order named, the sand-walls, water-proofing, conduits, bench-walls and finally the arch. Concrete was placed during the day shift only, the forms being moved partly at night and partly on the alternate days when the concrete was not being placed in them. Five gangs were organized at each end, the first placing concrete in the foundations in both tunnels as the excavation was ready. In each tunnel there was a gang which built sand-wall one day and bench-wall the next, the two tunnels alternating so that only one bench-wall was built each day, and finally a gang in each tunnel building arches, a ten-foot section being completed each day. During the night shift the arch forms and travelers were moved, and all other forms, etc., were made ready for the concrete to be placed the following day. Some of the conduit laying was done by the night shift, but part of it was necessarily done during the day, as the concrete was built up. A small gang was kept busy in both tunnels during the day shift laying conduits and waterproofing, these two operations being performed by the same gang.

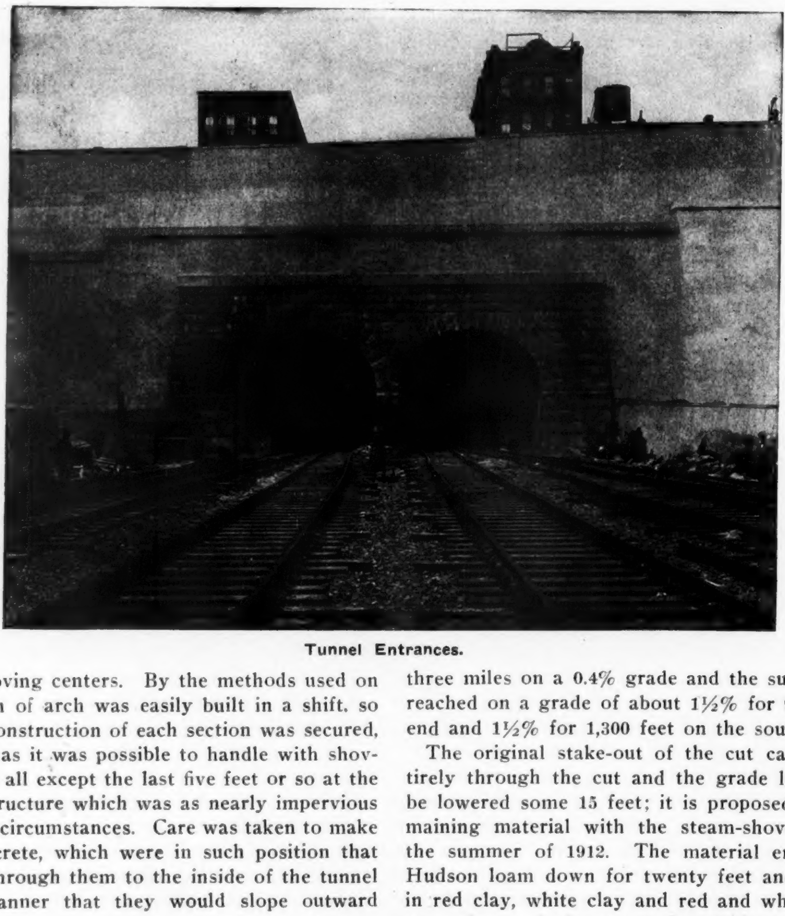
All the concrete used in this section was mixed with Hains mixers, one being at each end, and they proved very efficient on this work. The largest number of full batches (0.8 cu. yd.) mixed in one plant per hour was about 35, the largest number per day of 10 hours about 240, but the apparatus was never worked to its full capacity. The concrete for the floor, ditches and foundations was brought into the tunnel in V-shaped steel dumping cars, and the concrete for the arches and bench-walls was loaded at the mixers in 1-yard Stuebner bottom dumping buckets, which held a 4-bag batch.

In designing the forms for all exposed surfaces in the tun-

nels, it was the desire of the contractors to obtain directly from them a surface which would be satisfactory to the engineers without further finishing than the patching of minor defects. In this they were generally successful, and excellent results were obtained. The surface of the bench-walls was obtained solely by spading the face with a flat spade as the work progressed. No after treatment was resorted to except for the few sections where the forms became worn. The top of the bench-wall was finished with a float about two or three hours after the concrete was placed.

In concreting the bench-walls, the concrete was first placed on the side containing the single conduit until it reached the top of the four tiers laid, then the concrete gang was turned over to the side with the 4-way conduits while four more tiers of single conduits were laid, the work thus progressing, the conduits being laid on one side while concrete was placed on the other.

The arches were built in 10-foot sections, the ribs being spaced 5 feet apart; the end ribs of each section supported the end of the lagging on two adjoining sections. Five sets of lagging and ten ribs were used at each place where the arch was being built, thus giving each section practically four days' set before removing centers. By the methods used on this work one section of arch was easily built in a shift, so that the monolithic construction of each section was secured, and concrete, as wet as it was possible to handle with shovels, could be used for all except the last five feet or so at the top, thus getting a structure which was as nearly impervious as possible under the circumstances. Care was taken to make all joints in the concrete, which were in such position that water might follow through them to the inside of the tunnel lining, in such a manner that they would slope outward toward the rock.



Tunnel Entrances.

Hackensack Portal and Approach

The approach cut at the eastern end is 300 feet long. The bench-walls and conduit lines built throughout the length of the tunnels are extended through the approach cut. The retaining walls were built in 25-foot sections, the joints corresponding to those in the benches. The back part of the joint was mopped with hot pitch before the next section was built so that there was practically no bond between any two adjoining sections. The concrete in these walls was placed late in the season and the expansion cracks, which were entirely confined to the V-shaped joints, were quite small, even in the coldest weather of the following winter. The forms for the concrete in the approach were made of ordinary dressed lumber, and the surface was rubbed twice after the forms were removed, which was as soon as possible after the concrete had set. The surface was first very lightly rubbed with a piece of soft, light colored sandstone to remove any irregularities, being wetted slightly if necessary while being rubbed. A second rubbing after the concrete had become fairly hard and dry gave a uniform texture and color.

INTERESTING CONSTRUCTION JOB.

The Louisiana Railway and Navigation Company in connection with the construction of their new line has been making a very deep cut between Bayou Sara and Angola, La. This cut is called "Tunica Hill Cut." The cut is 2,300 feet long and has a maximum depth on the high side of 130 feet and on the low side of 120 feet.

Three hundred and fifty thousand yards of earth were taken out by contract and during the fall of 1910 and spring and summer of 1911 the railway company removed two hundred and twenty thousand yards by steam-shovel and cars. The cut is approached on each side for a distance of about three miles on a 0.4% grade and the summit of the grade is reached on a grade of about 1½% for 900 feet on the north end and 1½% for 1,300 feet on the south end.

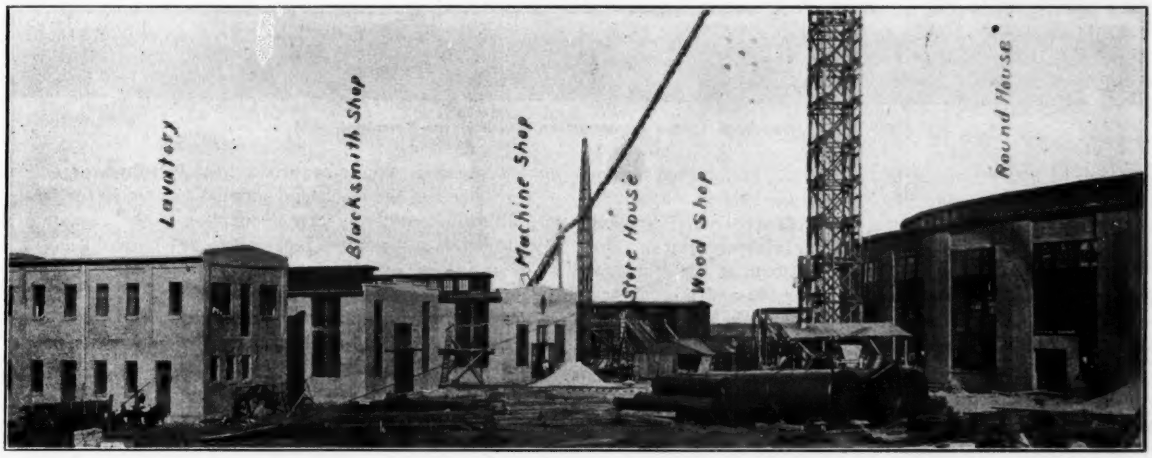
The original stake-out of the cut carries 0.4% grade entirely through the cut and the grade line will still have to be lowered some 15 feet; it is proposed to take out this remaining material with the steam-shovel and trains during the summer of 1912. The material encountered was Port Hudson loam down for twenty feet and after that it varied in red clay, white clay and red and white sand with a stratum of gravel about two feet wide.

Tunica Cut is about one and one-half miles from the Mississippi River and on the side towards the river there was a very large quicksand pocket about one-half the distance throughout and something like one hundred and forty thousand yards of dirt slid into the cut at various stages of excavation and had to be removed.

When the temporary 1½% grade, which is in this cut now, is removed next summer this line will have a 0.4% grade from Shreveport to New Orleans as the balance of the line was planned and completed with a maximum grade of 0.4%.

Sweetwater Terminal, A. T. & S. F. Ry.

The Atchison, Topeka & Santa Fe Ry. has just completed a roundhouse and terminal buildings at Sweetwater, Texas. This is in the central part of the state on the Texas-Coleman cutoff, a line which greatly shortens the Santa Fe's route from Galveston to the Pacific. The improvements include an 18-stall roundhouse, blacksmith shop, machine shop, woodworking shop, powerhouse, storehouse, lavatory building, coal chute, sandhouse, cinder pit and station. With the exception of the station the relative position of these buildings is shown in the drawing.



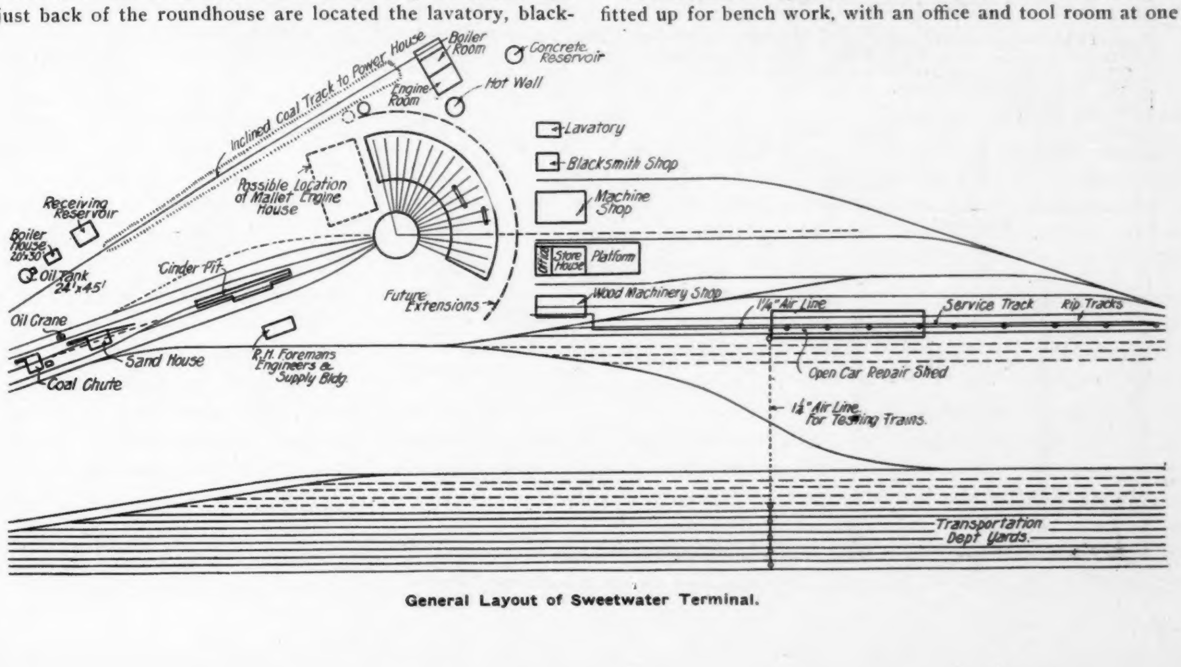
Sweetwater, Texas, Terminal, A. T. & S. F. Ry.

The roundhouse stalls are 92 ft. deep and three of them are equipped with drop pits containing the standard Santa Fe hydraulic jacks. A 44-ft. traveling crane with a capacity of 7½ tons has also been installed. At the permanent end of the roundhouse space has been left for a 133 x 173-ft. Mallet engine house and enough clearance has also been left so that the outer circle may be extended if this should be thought the most desirable way of taking care of the Mallets. The turntable is an 85-ft. span and is equipped with a Nichols turntable tractor, manufactured by Geo. P. Nichols & Bro., of Chicago. The tractor operates on a 440-volt, 60-cycle, 3-phase current.

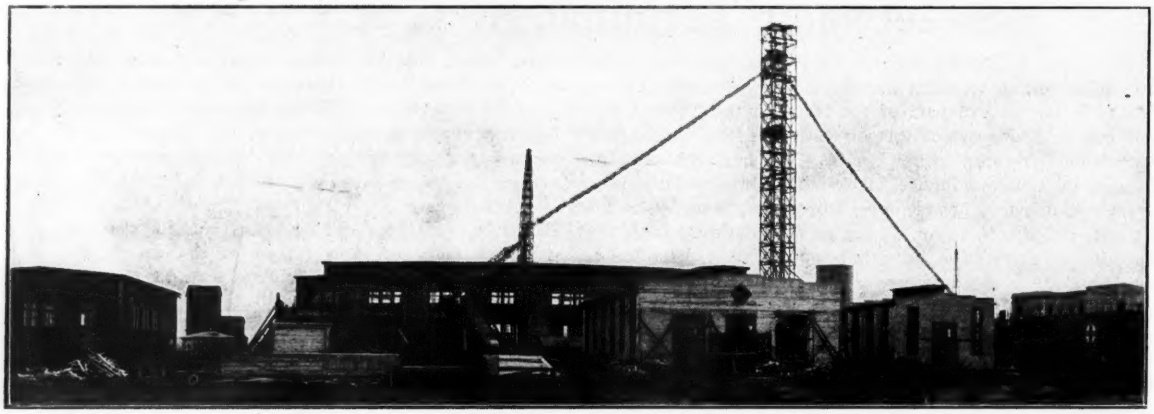
North of the roundhouse is located the powerhouse, and just back of the roundhouse are located the lavatory, blacksmith shop, machine shop, storehouse and woodworking shop, as shown in the photographic illustration. The powerhouse is 60 x 75-ft. and is divided into an engine room and boiler room by a wall through the center. In the boiler room are three 78-in. by 18-ft. Murray return tubular boilers of 175 horsepower each, and working at 125 lbs. pressure. Also two Knowles 7½ x 4½ x 10-in. feed pumps, two Knowles 14 x 8½ x 12-in. duplex pumps for general use, and a Colles 1,000-horsepower feed water heater. The boilers have metal stacks 40 in. in diameter and 70 ft. high. The power units in the engine room consist of two Curtis turbines direct connected to 480-volt, 60-cycle, 3-phase General Electric generators running at 3,600 R. P. M. The turbines are non-condensing. Compressed air is supplied by a cross compound, two-stage air compressor. Most of the fittings in the powerhouse are Crane fittings and are extra heavy.

The lavatory building is well fitted up with toilet facilities, is large and roomy and has space to spare for other purposes. The blacksmith shop is 36 x 46 ft. and contains three forges, a 1,100-lb. Niles-Bement-Pond hammer and a Niles flange clamp. There is also room for additional forges. A post crane of 14-ft. radius serves the center of the building.

The machine shop is 60 x 100 ft. One side of the shop is fitted up for bench work, with an office and tool room at one



General Layout of Sweetwater Terminal.

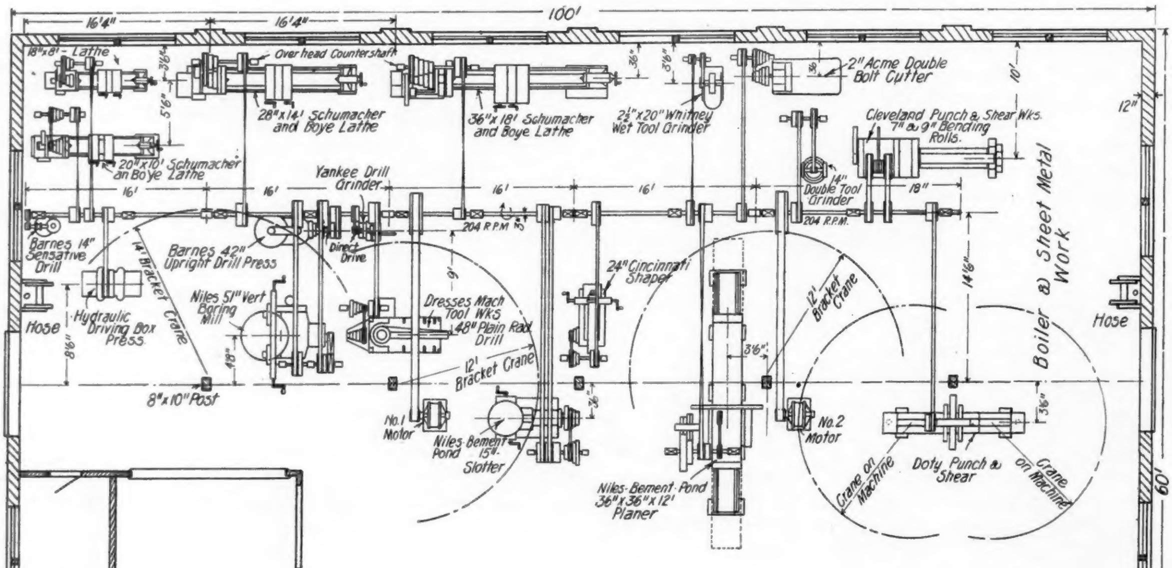


Buildings Under Construction, Sweetwater Terminal.

corner. The larger portion of the building is occupied by the machine tools, power for which is supplied by two 25 H. P. motors belted to a single line shaft. Three radial bracket air cranes are used for serving the heavier machines. The storehouse is 60 x 122 ft., and has a platform at the rear 60 x 125 ft. The wood shop building is 40 x 100 and is equipped with four machines, as shown in the table below. A service track extends through the building.

Between the powerhouse and lavatory is a concrete cistern 50 ft. in diameter and 15 ft. deep, having a capacity of over 191,000 gallons. It is supplied through an 8-in. pipe which connects it to the lake. The suction of the high pressure pump in the powerhouse is connected to the reservoir through an 8-in. pipe and the discharge is connected to a fire line of 8-in. pipe, with reductions to 6 in. In this line is a 24 x 60-in. steel tank and the line extends to the various buildings with hydrants where necessary. The suction of a duplex pump is connected to a hot well just outside the powerhouse and the discharge supplies hot water for washing and filling locomotives. Air is supplied to the various buildings through a 3-in. pipe, tapering to 2½ in. and 2 in. Most of this line is overhead on supports. Steam is supplied through a 2½-in. line from the powerhouse. Lavatories are connected to an 8-in. sanitary sewer and a 12-in. waste water sewer, with 6 and 10-in. branches, connects the cinder pit, turntable pit, drop pits and powerhouse.

All of the buildings with the exception of the wood shop are of reinforced concrete and were constructed by means of the tower and two chutes shown in one of the illustrations. The wood shop is sided with corrugated metal. Roofs are of wood, covered with a composition roofing. The work was done by the Witherspoon-Englar Co., Monadnock Blk., Chicago, general contractors, and under the supervision of F. H. Adams, engineer of shop extension.



Machinery Layout, Sweetwater Terminal.

CONCERNING THE RAILWAY SITUATION.

By Chas. H. Reid, V. P., Zug Iron & Steel Co.

In the daily grind of the press detailing the methods and probing of congressional committees into various types of so-called trusts, and by the Interstate Commerce Commission in the operation and regulation of railways, the primary object appears to be, not to try to discover how to correct faults that are the outgrowth of a bad system, but if possible to fasten the stigma of crime upon some individual or concern prominent in the business life of the country, for deliberate or technical—very often the latter—violation of federal laws and to magnify it into a heinous offense worthy of condign punishment.

The causes of the sudden slump in fall of 1907, primarily local, and largely the natural sequence of high pressure business overdone, and later accentuated by a more radical application of the Sherman Law to railway affairs, have now grown to the proportions of national issues. The elections of some months ago changed the political complexion of congress very materially, and the ambition of some new members to insert probes into every type of industrial combination has accentuated the uncertainty and added to the distrust that has so long paralyzed industrial activity.

Ostensibly this zeal for law observance is in the interest of the poor consumer, but the fervor of patriotism is too thin to prevent the politics and personal prejudice from showing, and the public is fed ad nauseam upon "discoveries" that have been common knowledge to ordinary readers and that have been openly accessible at any time to fair-minded, unbiased investigation. Show us the committee of the several that have lately been junketing about the country, jabbing at little blisters in corporate bodies, that have been sufficiently unprejudiced to investigate to a finality, the degree of injury resulting to the ordinary citizens from these technical violations, and whether the consumer is not being penalized in a ten-fold ratio by these same committees in the continued disturbance of public confidence, and an unnatural industrial depression that has lasted nearly four years, and during a period too when the general prosperity of the country has never been surpassed.

The Sherman Law was passed over twenty years ago, and the last sixteen years of its existence have been continuously under Republican administration. During this latter period there has been more open violation and technical evasion of the law, in over-capitalization and manipulation of railway properties by promoters and financial syndicates; more development of the "trust" idea, with all its real and fancied possibilities for evil, than was ever even dreamed of before. The attitude of these administrations not only discredited the law, through lack of earnest effort to vindicate it, but by their inaction fostered the idea that it would not stand the test. The best legal talent all over the country was employed during this period, as never before in our history, in teaching corporations and financial syndicates how to evade the spirit and intention of the law through possible or fancied defects in its letter, in the formation of combinations that are now bitterly arraigned as law breakers.

It was not until the second term of Roosevelt's presidency that sincere effort was made to test the strength of the Sherman Law, and since its vindication by high court decisions, its application to some interests vital to the country's prosperity has been so uncompromising and so utterly inconsistent with the attitude of administrations for ten years previous, that the consumer has suffered vastly more in the four years of law enforcement since 1907 than could possibly have resulted to him under the old regime in double the period. Take the railways that for the past four years have been made special objects of uncompromising federal regulation under this 20-year-old law. They have not only been subjected to rigid interpretation of present law, but have been constantly menaced with other drastic legislation which has continued them in a state of deplorable uncertainty as to what they should or should not do until this new legislation is duly defined and its limitations fixed. There is no other single factor, or several combined in our national life, whose depression or normal operation affects the daily comfort and well-being of so many people in the ordinary walks of life as does that of the railway. In normal operation of the latter it is claimed a million and a half of employes receive a constant wage.

It is a very reasonable presumption that five or six persons are directly or indirectly dependent in a large degree upon each of these million and a half of railroad employes, either as relatives, or the tradesmen who supply their daily living needs. Add to these the very large number employed in the shops and factories that manufacture various types and parts of railway equipment who have been working only from 25 per cent to 50 per cent of the normal activity, and you have approximately one-tenth of the population of the whole country that has been very materially affected by the tedious and labored decisions of the Interstate Commerce Commission, or the political demagogery that has obtained in congress and committees, the members of which are constantly seeking for new marks for the probe, or individuals to indict.

The railways of the country, with their 230,000 miles of track, take for their upkeep, extension and renewal of equipment when in normal operation, nearly one-third the output of the iron and steel mills of the country, or approximately 9,000,000 tons of their products per annum. In any one of the past four years, because of the uncertainty referred to herein and of the almost constant political agitation of some sort, the railroads have drawn scarcely one-third of the above tonnage, and because of general distrust and unsteady prices, other industrial enterprises than iron and steel have suffered unnatural depression. The natural sequence has been, suspension of some mills, half operation of nearly all others, and non-profitable operation to a large number during most of this period. What particular type of consumer has been benefited by this costly demonstration? And what about the horde of consumers who have worked but half time because of the manner of demonstration, and of the politics that throttle the best intentions of the law? Any national law the purpose of which is to be corrective and constructive, certainly contemplates the greatest good to the greatest number, and is neither local or sectional. Whatever latitude or discretion is permitted in its interpretation and enforcement, should as certainly be measured with reference

to the general good, and be sufficiently elastic to include the possible remote sufferer as well as the immediate beneficiary affected by a ruling or decision. No thinking person sincerely decries the Sherman Law or denies its power to regenerate bad systems and by co-operation make them good. And why not co-operation? The railroads of the country have grown into bad habits both in financing and extravagant operation, because the enforcement of this law was grossly neglected for nearly two decades.

If the Interstate Commerce Court and Committee have the broad discretionary power their decisions warrant the people in believing, why can they not and why should they not, co-operate with railroads, to some extent at least, to restore industrial activity by favorable consideration of reasonable advance? Why not consider the millions dependent upon railroads for direct and indirect support, as well as try to promote the profit of shippers, by spending months in measuring the exact equities between different localities, while the wheels of industry stand awaiting the verdict relating to a single class of commodity? Early in 1910, encouraged by popular sentiment, and believing the promised era of prosperity was about to set in, the labor organizations of railway employes throughout the country began to formulate demands for higher wages and easier working conditions.

Many of the leading railway lines recognizing the trend and force of this sentiment, anticipated these demands and their attendant strike fever, by voluntary advances and concessions, and then announced an advance in freight rates to recoup this extra drain on their income. This advance was denied entirely by the Interstate Commerce Commission. Had the railways been granted half the increase asked for at that time, and had the commission at the same time required of them the creation of surplus funds from their income, for the gradual reduction of their inflated capital, and the betterment of their investment, and had measured them to periodic audits in which results satisfactory to the commission must be shown, there is little doubt but that the industrial situation of the country would be vastly better than it is today, and the little added burden to shippers through such increase would not have been a tithe of that imposed upon the whole manufacturing area of the country by the uncertainty and depression that is almost if not quite as pronounced today as two years ago. Under such concessions and requirement the railways would have been steered out of the sea of uncertainty, would have known what they could and must do. A large part of the increase granted would have gone into circulation for material for the much needed betterment of their physical condition, put the mills into fuller and nearer normal operation; employed thousands more men on full instead of half time, and because of the required creation of stock redemption funds, the same economic practice and efficiency methods that are now being inaugurated on many railway systems, would have been just as necessary and a natural sequence. This latter, too, would accomplish gradually the getting back to physical and intrinsic value, without the bogey of special federal legislation. The railway problem is a big and vital one, and should be handled with less public rancor and without prejudice. An aggregate proposition affecting nearly ten millions people and many billions of investment, requires very consistent treatment, and faults of fifteen years' growth cannot be purged in as many months, without tremendous and paralyzing shock. Demand better standards, and sincerely co-operate in securing them. Evolution is better than revolution. The railways are the pulse of the country, the arterial system of our commercial and industrial life, and at this critical period of their existence need a good health-restoring tonic, instead of phlebotomy and continued diet of political wind pudding.

RAIL DEFECTS.

The danger zone in the use of steel rails as at present manufactured has been reached, according to a statement of Chief Inspector H. S. Belnap of the Interstate Commerce Commission in a report to that body. If heavy, high speed trains are to be run in safety, Mr. Belnap declares, scientific investigation of the causes of rail defects must be undertaken with a view to remedying an existing trouble. Accidents due to defective rails are increasing constantly.

Mr. Belnap's report deals primarily with the wreck of the G. A. R. excursion train on the Lehigh Valley railroad near Manchester, N. Y., Aug. 25, when "a fundamentally defective rail" cost twenty-nine lives. The rail was broken into seventeen pieces and was found to contain many "slag splits." In the head of the rail there were transverse fissures, which the report declares "cannot be detected except by chance."

While the report holds that the defects were of such a character that once the rail was placed in the track careful investigation would fail to disclose them, it also contains the following:

"Our investigation further disclosed the fact that the Lehigh Valley railroad was cognizant of the fact that there were defective rails in service of the character of the rail herein questioned, as evidenced by letters of instructions to subordinates."—*Chicago Daily News.*

EMPLOYER VS. EMPLOYE.

J. F. Jarrell, publicity agent A. T. & S. F. Ry., in giving a talk to a gathering of employes of the road, is quoted from the Santa Fe Employes Magazine as follows: The thing that counts most in the world today is merit. A man with ability to accomplish things may aspire to the highest job on the list. We, the American people, in casting about for a man for foreman, or superintendent, or governor, or president, don't ask, "Who was your great grandfather?" We ask, "What can you do?"

We want results. There is no standing still in this country. We go forward or we go backward. We demand continued improvement. We won't tolerate anything that does not spell growth and development. It is a characteristic of our people our country and the age in which we live.

Holding down a job should mean more to a man than listening for the whistle and getting his paycheck. Do not regard this as a reflection upon the whistle or the paycheck, for both are of utmost importance; but the man with a job should feel a responsibility in addition to the whistle and check factors.

The man who has no respect for his job cannot have much respect for himself. If he respects his job he will take pride in his work and put forth his best licks to make good with his employer. His work will show merit. The employer will see results, appreciate the efforts of the employe and make appropriate reward for the efficiency shown.

In order that both employer and employe may be successful in their aims, there ought to be close co-operation between them. The employer should have the interest of the employe at heart, and the employe should take an active interest in the welfare of his employer.

– NIGHT EDITION –

The Engineer's Distress.

J.J. SORENSON. A.S. GUNN. } EDITORS. | VOLUME I. | BOONE, IOWA. | No. I | A.S. GUNN. J.J. SORENSON } ARTISTS.

THE WEATHER.

Warmer indoors than out if your Rent is paid.

The sun rises and sets (at ease) so also doth the Grand-son, cousin, nephew, et cetera. ad infinitum.

Dont kick, – BOOST. that's what they all SAY.

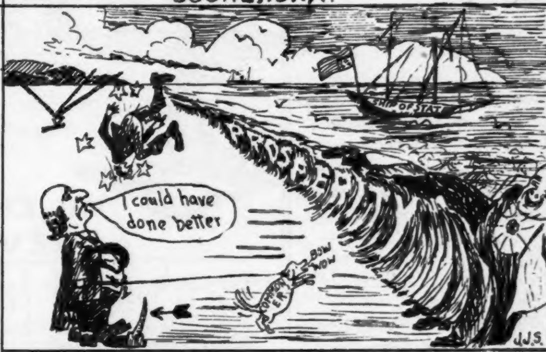
HA! HA! HA!
OUR REPORTER IS AMUSED AT THE ANTICS OF THE LEARNED MEDICOS. CALLS THEM OLD FOGIES.

Special to The Distress.–

Libertyville Dec-14-08.

Our local physicians are greatly puzzled, over the strange death of the six months old child of Ass't Engineer Starving. It appears that the child died from lack of nourishment. This is said to be a very rare occurance in one so young. Our venerable Dr. Pod-ibus, who is in his 85th year, states that this is the first time in his notable career that such a case has come under his observation. Cheer up old fogies if the present prosperity continues there will be no dearth of such novelties.

For much money maketh the Stomach sick. ROCKEFELLER;



AS IT LOOKS TO US.

BIG SLUMP — IN — SYMPATHY MART.

NO GLOOM IN SIGHT.

We called on our friend, H. I. Slimbelly to offer our condolence. Mr. Slimbelly was recently reduced from instrumentman to rodman: and as we have been there our-selves can appreciate his misfortune. To our surprise we were met with a wreath of smiles; the cloud of gloom being Hors de Combat. Mr Slimbelly informed us that he was alredy so reduced that he did not believe he would notice the change.

Editors Note:– Another recruit for the Sunshine Club. Good work Slimbelly.

KEEP SMILING

SMILE DEM YOU SMILE.

— A LIE. — POSSIBLY.

CHICAGO, ILL. Special Wire.

It is currently reported, that the Nill Western and Crooked Ry. Co. is about to reduce expenses for the Winter, by dispensing with its Engineering Department.

EDITORS NOTE.–

We recieved the above dispatch just before going to press, so are unable to verify it; but it does not ring true as it costs practically nothing to maintain an Engineer Corps and THEY WORK WHILE YOU SLEEP.

EDITORIAL

Of late we have heard considerable criticism, directed in particular against the Engineer Corps, charging a general lack of interest in the welfare of the nation and a failure to take a stand in politics.

It is openly charged that many of the Engineers do not take the trouble to go home and vote. About this last charge we have nothing to say, as this lies between a man and his BOSS. It was our intention to write a long and exhaustive article covering in detail the above criticisms. Through the brilliant efforts of our well known cartoonist, which adorns this page, we are spared the burrowing through an obtuse editorial. One can see at a glance that the representative Engineer in our cartoonist's picture is far too busy to take a stand any where, and it is obvious that his position is not conducive to deep political research.

A study of this picture will convince our readers that the above criticisms are unjust and absurd. There is however one criticism which we are forced to make against the corps. We hesitate to do this, for it is our conviction that it is due, more,

CONTINUED COLUMN 1, PAGE 2.

Reproduced from Tracings Made by A. S. Gunn and J. J. Sorenson.

THE ENGINEERS DISTRESS 2

The Distress.

FOUNDED IN THE REIGN OF PROSPERITY.

TERMS OF SUBSCRIPTION.
Jolly the publishers and get copies free. Ten cent cigars and good drinks accepted in place of a jolly. Suggestions received cheerfully but will not be acted upon. Entered as worst-class Rail-way Mail Matter. Nov. 18-1908.

CONTINUED FROM COLUMN 4 - PAGE 1.
to thoughtlessnes than design.
We refer to the pestiferous habit of kicking. *The man in the picture represent YOU— Mr Engineer. Do you not see the absolute futility of Kicking? A jock-ass can kick better than you can and to more purpose.* If you can not be the real thing don't be a weak imitation.

In our next issue we will discus "THE CRIME OF OVEREATING."

THE LIMIT.
It is reported that the dastardly thieves who rifled the boxes containing the Thanksgiving turkeys sent out by the management for the Engrg Department, perpetrated a low joke by refilling the boxes with lemons, and restoring them to their original appearance. This is the limit

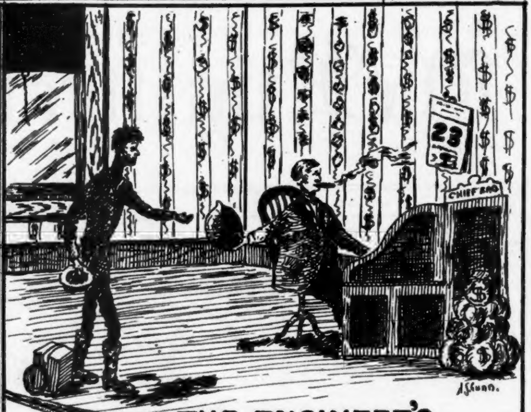
WAKE UP!

SEND IN THE AMOUNT OF YOUR CONTRIBUTION

According to the pro-election agreement, we will in our next issue publish in full the list of the contributors from the Engineering Dept. to the Sinking Fund of $5,000,000.00. Several members of the corpse have been heard from. It appears that the contributions vary from $150.00, to $550.00 for which stock will be accepted if tendered. We view this proposition with favor and advise its acceptance if made. This will relieve the Corpse Members from the fatique of toting the coin.

"SMILE AND THE WORLD SMILES WITH YOU SNORE—AND YOU SLEEP ALONE

(Apologies to a dead jokesmith)



THE ENGINEER'S REWARD

PROSPERITY WITH A VENGEANCE

Asst Engineer Moneysax, variously known as the "Konay kid," and the "Ladies Delight" has sprung the final proof of the decline and death of the recent panic. Mr. Moneysax has lately imported a 90 horse-power Mercedes, and is cutting a truly Parisian dash skittering about the town and the surronding landscape. It is needless to state that several members of the fair sex are dee-lighted while others are wearing green goggles as a protection from the glare of the sun. The auto is a beaut and is fitted with all the latest fads and fancies, including electric lights, foot warmers and a mock moon for use on cloudy evenings. Bravely done Bill!

We question the verocity of the above article but pubish it on account of its true ring of prosperity.—EDITOR.

NO JANITOR REQUIRED.
ASST ENGR:— WHEN YOU GET THROUGH SCRUBBING THE FLOOR, I WANT YOU TO HURRY OUT THAT FINAL ESTIMATE FOR BOODLE & SOAKEM. I WILL MAKE SOME BLUE PRINTS.
RODMAN:— DON'T YOU WANT ME TO WASH THE WINDOWS FIRST?

I WONDER WHAT NEXT.

NOT GOOD ON LIMITED TRAINS
1, 2, 7, 8, 11, 12 OVERLAND: 305, 306 ST. PAUL: 9. CHICAGO TO MILWAUKEE

CHICAGO AND NORTH WESTERN RY.
Lines East of Missouri River

PASS A. Draftsman & Family
Over Ties of ALL DIVISIONS
until DECEMBER 31ST 1908 Subject to Conditions on Back

This Pass NOT GOOD on Any Trains

No E 41144

R. H. Aishton
GEN. MANAGER

To be Continued

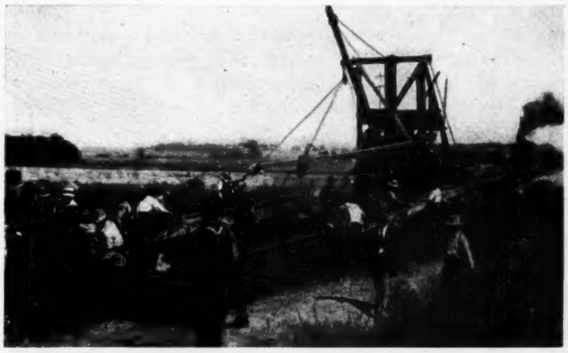
OPERATION OF A ROBERTS TRACK LAYING MACHINE.

By C. L. V.

The following description of a Roberts track laying machine was made when carrying material for one mile of track.

The train carrying the machine is made up as follows, beginning with the "pioneer car," which always remains at the "front," and is not changed out as are the other cars in the train. Immediately behind the "pioneer" are five cars of rails, then the locomotive, and behind that eight cars of ties; next comes a car of tie plates when they are used, the "trailer," which is a car carrying spike, bolts and base plates, a car of plank for crossings, a car of cattle guards, a tool car and the way car. This makes twenty cars, and all are flats except the two last mentioned.

The first car of rail behind the pioneer is "trimmed," that is, on it is loaded angle bars enough to lay the amount of steel carried on the train. The angle bars are carried forward over the pioneer car and delivered as needed to the "strap hangers" in front.



Pioneer Car, Roberts Track Layer.

The rails underneath the angle bars are the last ones laid from the train, in order that the angle bars will be cleared off of the rail by the time rails are needed. The car next to the locomotive carries short lengths of rail to be used when necessary to keep joints from coming close to bridge ends.

A system of trams is used to carry the ties and rails to the front. The trams are made in sections, each 33 feet long, the sides consisting of 2½x10 inch planks. Tie trams are 14 inches wide, and rail trams are 12 inches wide. The trams are held together by bolts on which are pipe separators to hold the sides the proper distance apart. Near the bottom of the trams are live rollers, which complete a trough shaped way for ties or rail.

On the pioneer car is installed a 20 H. P. upright engine for driving the live rollers in the trams; this is done by means of a tumbling shaft and gear or cog wheels. Steam for the stationary engine is piped from the locomotive. The shaft is fitted with "patent couplings," that is, on one end of each section is a casting containing a square socket into which the end of the next rod fits. Each length of tram has a section of the shaft bolted to it and as the trams are hung the rods are fitted together, thus forming a continuous shaft. The trams are "hung" on iron brackets or trusses which hook into the stake pockets on the cars. The trusses are made with flanged rollers on which the trams are placed, thus taking care of the slack of the train in starting and stopping. The trams have a coupling device which holds them together, the ones on the pioneer being permanently fastened to the car.

The tie trams, 660 feet long, are operated on the right hand side of the train. Those for the rail, 240 feet long, are on the left. The movement of ties and rail is controlled by the "dinkey skinner," i. e., the stationary engineer, so as to deliver them in front of the train as needed. A tie chute 53 feet long provided with dead rollers is attached at the front end of the tie tram on the pioneer and through this chute the ties are pushed by the ones coming forward over the live rollers. And as fast as they are delivered at the end of the chute they are taken by "tie buckers" (laborers) and are placed across the grade ready for the rails.

A similar chute attached to the rail tram provides a way for delivering the rail in front of the pioneer. These chutes are supported at the outer end by cables attached to the rear end of the pioneer car and carried up over a high frame work or "gallows" on the front end. A boom, also attached to the front end of the pioneer car extends far enough ahead to have the cable attached to it reach the middle of the rail when placing it in position in track. This cable is operated by hand with an ordinary crab. Instead of cranks, a small light buggy wheel is used by the operator to wind up the cable, which lifts the rail and holds it while the "heeler" and his assistants place it in position in the track. (A newer device handles the cable with compressed air). The rails are placed in the trams by three men, and are handled in front by four more. One man on each car places the ties in the trams. The spikes, bolts and base plates are peddled from the trailers as the train proceeds.

The rails are held to gauge by bridle rods until the train passes over, all spiking being done in the rear.

The train moves ahead one rail length at a time when laying square joints, and half a rail length when laying broken joints.

The trams are taken down when cars are empty and replaced on the loaded cars when a new train arrives. 100 to 125 men are required for a full crew. Under ordinary conditions a mile of track is laid in from three to four hours.

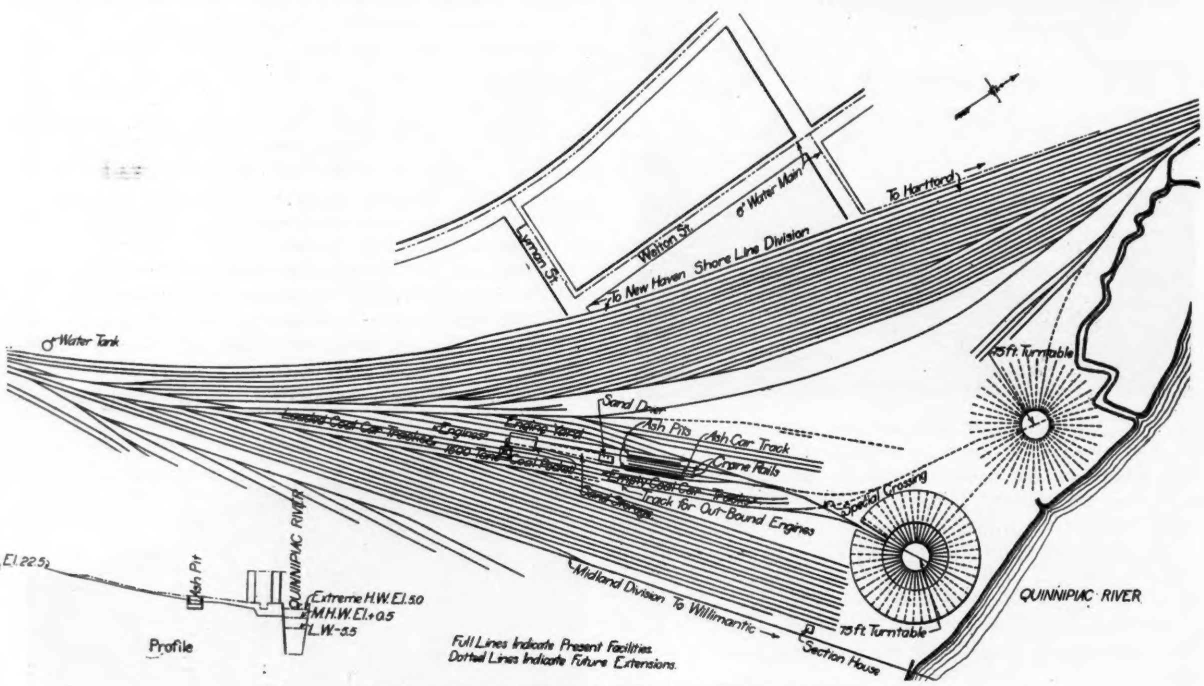
Showing Location of Engine Between Rail Cars and Tie Cars, Roberts Track Layer.

A contract has been given to E. G. Griggs, San Francisco, Cal., to build an addition to the freight car repair shop of the Western Pacific at Kirkham street, in Oakland.

The directors of the Wichita Union Terminal have authorized a mortgage of $2,500,000 on the property for track elevation, the building of a viaduct and the construction of the union station in Wichita. The roads interested in the station are the A. T. & S. F., C. R. I. & P., St. L. & S. F., and the K. C. M. & O.

REINFORCED CONCRETE ROUNDHOUSE FOR THE NEW HAVEN R. R.

The New York, New Haven & Hartford R. R. has under construction, according to the "Engineering Record," a large reinforced concrete roundhouse at the Cedar Hill freight yards in the city of New Haven and about 2 miles from the present passenger station. This circular structure, 360 ft. in diameter, contains stalls accommodating 43 steam locomotives or 86 electric locomotives and will be used in lieu of several smaller roundhouses. It is located on the west bank of the Quinnipiac River and when completed will be the largest roundhouse in the New Haven system. Both freight and passenger engines will be stalled in the ring, which is 86 ft. wide and about 35 ft. high with a reinforced concrete roof covering the entire area. Within this covered ring is an open area 188 ft. in diameter, in the center of which is being constructed a 75-ft. half-through steel turntable. The site is about 3 miles upstream from the mouth of the river in the New Haven harbor at a point where the land is marshy and often covered with water at high tide.



General Layout of Cedar Hill Yards and Engine House.

Because of the unfavorable nature of the underlying soil it was an extremely difficult proposition to prepare it for the foundation and besides the river is about 20 ft. deep at a distance of 25 ft. from the outer wall of the roundhouse, which necessitated some means of preventing the bog from working into the stream when the weight of the fill is imposed upon it. Accordingly, after the piles had been driven, the river bank was rip-rapped with 1,000 tons of large stones averaging about 1.5 cu. ft. in size. Tests showed the bog to be about 3 ft. deep, under which was 15 to 20 ft. of silt and then a stratum of clay and sand over a bottom of hard clay.

About 4,500 spruce piles, 40 to 50 ft. long, were first driven by means of three pile drivers, one using a hammer of 2,200-lb. weight and two using 3,000-lb. hammers. These pile drivers were operated on timbers and rollers and were hauled to different parts of the work by means of a block and tackle. Each pile is loaded to between 7 and 8 tons. The foundations are approximately on a level with the marsh and about 30,000 yd. of cinder fill, 6½ ft. deep, will be used inside the walls of the roundhouse to bring the ground up to the level of the tops of the pits. This fill will be worked in from the upper edge of the rip-rap to further prevent possible movement of the bog.

A 12-in. cap of concrete was placed over the piles, the cut-off line of the top of the piles being 6 in. above the bottom of the footing. Five piles were driven under each exterior wall column and six ⅝-in. square twisted steel bars, 4 ft. 6 in. long, arranged in a circle were placed in the column foundation; the diameter of columns out to out of bars is 11 in. The distance between columns on the outer ring, under the exterior walls, is 25 ft. 7½ in. and the foundation wall is arched across this intervening space and reinforced with two 60-lb. rails embedded in the concrete to support the ring wall, which is constructed of both concrete and brick.

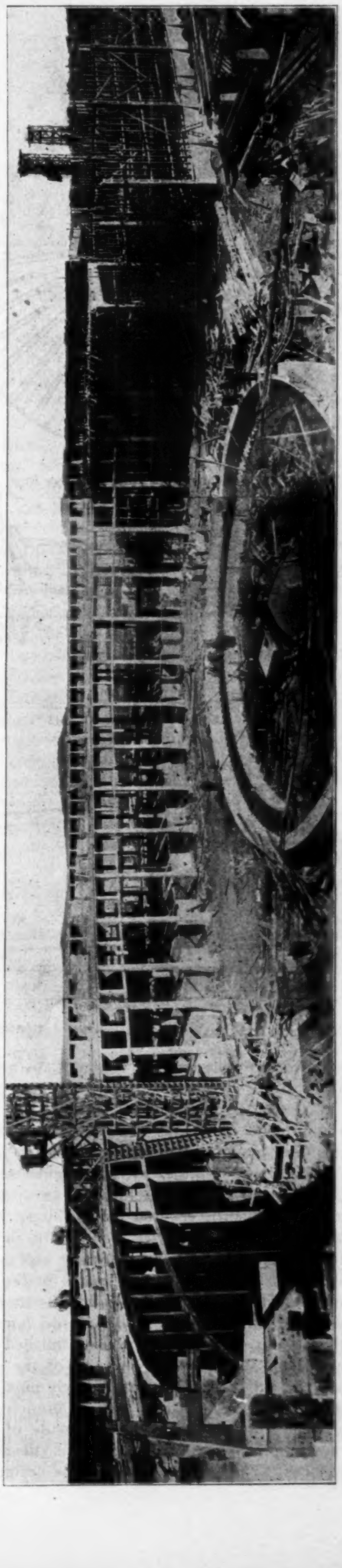
The top of all column foundations is 7 ft. above the cut-off of piles and the top of the rail is 5 in. above the top of these foundations. The column foundations are battered from the base up and vary in dimensions according to the weight imposed upon them. The bases are both square and rectangular in shape. Under the engine pit a 12-in. footing cap was placed over the piles and the tops cut off as described for the column foundations. The pit piles are spaced about 2 ft. center to center longitudinally and are arranged as shown on the plan. Two 15-in. vitrified salt-glazed sewer pipes were run out under the pit foundations for a heating outlet. Pit No. 31 crosses the center of the drop pit and the plan of foundation was altered to provide for the extra load at this point. The rails are run to the outer foundation wall, which is 4 ft. 8 in. x 10 ft. 6 in. at the base. Two 8-in. I-beams, 6 ft. 2 in. long, were used to reinforce this beam under the rails. These beams were set into slots in the piers at either end and rested on ¾ x 16-in. shoe plates fastened by 1¼-in. anchor bolts extending 8 in. into the concrete.

Each of the forty-three engine stalls has a pit 62 ft. long, 4 ft. 6 in. wide and 2½ ft. deep with a concrete floor laid on a well-rammed cinder fill and concrete foundation walls. The rails are fastened to the tops of the five foundation walls by means of ¾-in. dowel bolts cast in the concrete.

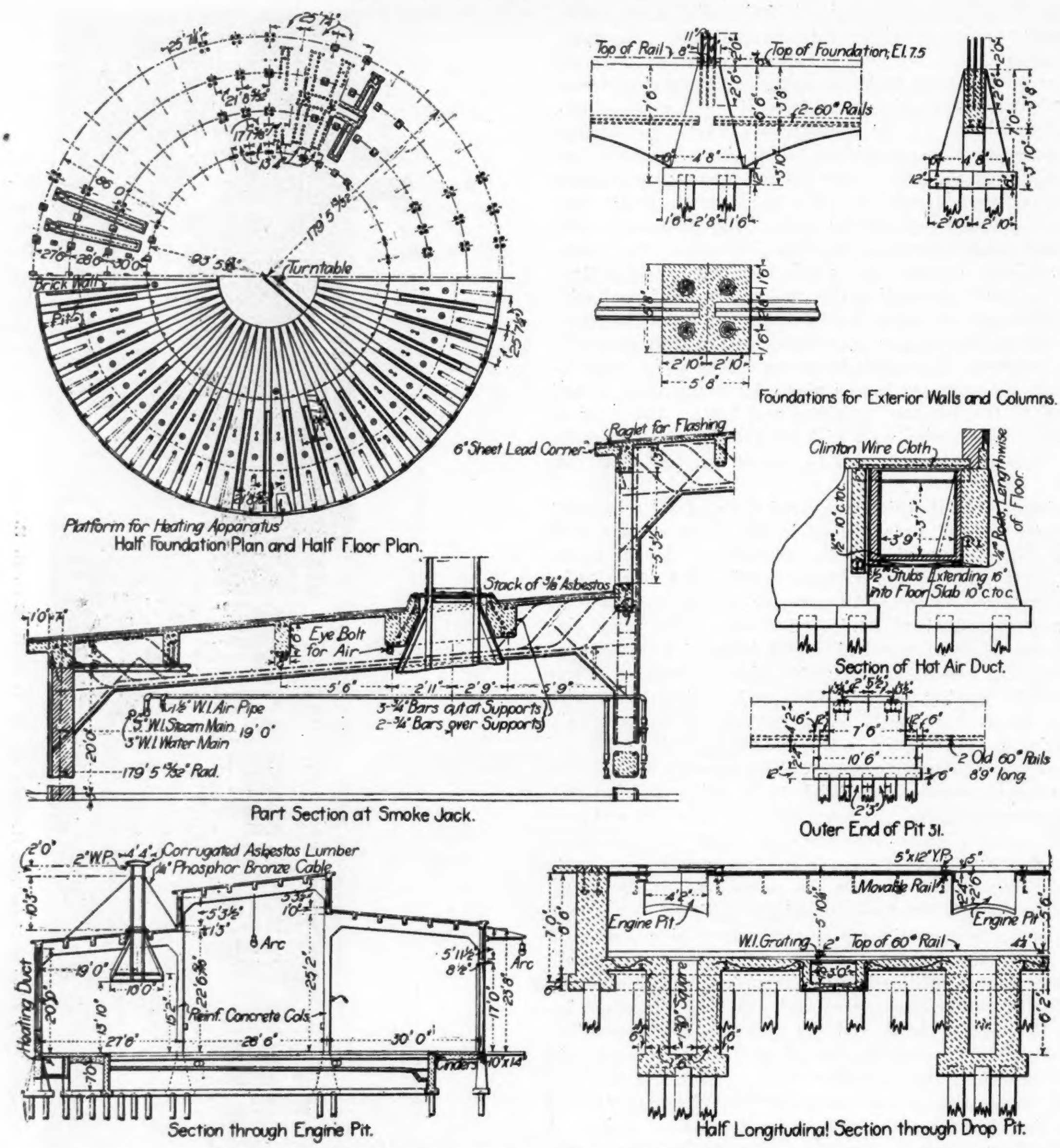
The bottom of the engine pits is built with a crown at the center, sloping to either side for drainage. Wrought-iron gratings with 2 x 5/16-in. slats are placed over the openings of the steam and drainage pits. Extending across three of the engine pits is a drop pit. Movable 100-lb. rails span this pit at the three points where the engines cross and 60-lb rails are laid on either side of the drop pit for transferring the parts taken out for repairs; these latter rails are greased in order to slide the transfer trucks over. Hydraulic plunger jacks under each of the three engine pit tracks are used to sustain detached trucks or other parts. A 6-in. I-beam trolley conveyor is installed over the drop pit. The beams supporting this trolley are reinforced with three ¾-in. rods at the bottom for the full length and two ¾-in. rods at the top for one-quarter of the span each side of the support. The track is supported by ⅝-in. rods attached to the concrete beams above by heavy anchors and fastened to the I-beams by plates and bolts. The floor of the engine pit is reinforced with expanded metal and 60-lb. rails. Square rods are used to strengthen the steam pit floor.

The long columns which supported the roof are reinforced by square twisted rods placed in the four corners and hooped with No. 3 wire 12 in. on centers. Metal corner beads on the legs of the columns consist of 2 x 2 x 3/16-in. angles anchored by means of counters and stove bolts 6 in. long and spaced about 24 in. on center. The same size angles are used on wood sills and fastened by means of long screws. Anchorage for the window buckwork was provided by leaving ⅞ x 6-in. slots and casting No. 9 wire anchors in the concrete 12 in. on centers. Continuous nailing strips 2 x 1½ x ⅞ in. were anchored in the sides of columns where it was necessary. The exterior walls above the foundation are built of brick 12 in. thick, and inclosed the entire engine ring. Between these columns, in each bay on the outside circular wall, there are large window sashes with 12 x 14-in. lights; the upper and lower sashes are made to slide for ventilation, while the center sash is stationary. The inner circle is fitted with wood slat rolling doors in each bay; the doors are built of Georgia yellow pine slats with glass panels inserted to give light at this point. Each rolling door has a small sliding wicket door which rolls up with it. A continuous line of sash takes up the space between the tops of doors and the roof levels. All mullions and sills are of concrete reinforced with square twisted rods. Cast-iron weights are installed for operating the windows on the outer circle of the house, and wood bucks, 2 x 4 x 8 in. in size, four to each jamb, serve for nailing strips. A wooden door opening outward is provided from the house to the entrance track and an iron ladder runs to the roof at the end of the entrance stall.

The roof is carried around the ring in three sections, the center portion, 28 ft. 6 in. wide, being elevated about 6 ft. to provide for the insertion of stationary and of pivoted sash with 12 x 12-in. lights for ventilation and lighting. The middle section slopes outward for drainage, while the two other sections are pitched as shown for the same purpose. The roof slab is 2½ in. thick of concrete reinforced with Clinton wire cloth and covered with a three-ply slag roofing. Large radial roof girders about 1 x 3 ft. and about 7 ft. on centers support all three sections of the roof. Square rods in the bottom varying in size from ⅝ to ⅞ in. serve as reinforcement. Some of these rods are bent up at the ends and over supports to provide for shear and negative bending moments, while others are bent through brackets into the walls and columns. Roof purlins averaging 5 x 12 in. in section and about 5 ft. on centers run the entire length of the roof sections and are reinforced with square rods placed in the bottom. Sheet lead cornices and drips are attached to the outer edges of the roofs. Conduits for electric light-



Construction View of Cedar Hill Roundhouse, N. Y. N. H. & H. R. R.



Details of Concrete Roundhouse, N. Y., N. H. & H. R. R.

ing are installed in the floors, roof beams, walls and columns.

The apparatus for heating the pits for workmen is being installed by the B. F. Sturtevant Company and consists of a No. 14 multivane fan, an 8 x 10-in. vertical engine and two independent groups of 1-in. wrought-iron pipe with a total of 8,730 lin. ft. of pipe, with wrought iron fresh air connection. Fresh air is drawn through an opening in the outer brick wall, which is covered with a louvre ¾ x 4 in. in dimensions and a galvanized wire screen of ½-in. mesh with channel frame, and forced over the hot-air pipe and through the hot-air ducts which are carried inside of the outer wall of the roundhouse to the trunks leading to the pits. This duct is lined with semi-porous hollow tile bonded to the walls with galvanized steel wall ties and finished with ½ in. of cement plaster throughout. The size of the duct diminishes from the fan connection after each pipe branch by sloping the sides and bottom. Each branch of hot-air heating system from the main duct is made of salt-glazed vitrified sewer pipe with necessary ⅛-in. bend increasers and Y-branches. The heating apparatus is designed to heat twenty-two pits at a time. Pipe hangers, which are made adjustable to take up or move over as desired, are cast into the concrete roof beams at required points.

A smoke jacket of standard design is being installed over the engine pits extending from the hood through the roof to a height of about 13 ft. A cast-iron frame is bolted to the concrete around the opening by 1 x 30-in. anchor bolts and fastened to the jack by an angle and ¾-in. stud bolts. The hood and stack are lined with ⅜-in. asbestos lumber furnished by the H. W. Johns-Manville Company.

The turntable is built of 17-ton plate girders which run on a bronze saddle or bearing at the center and sixteen wrought-steel center rollers set in under the track radially. Ball bearings were used around the outer ends of the table, which gives a rolling bearing in two directions, vertically and horizontally. Forty-nine piles, in seven rows 2 ft. center to center, were used under the center bearings and three rows of ninety-three piles about 2 ft. 5 in. center to center under the outer ring. Dowel bolts ¾ in. long were cast 7 in. in the concrete around the outer circle to hold the 8 x

12-in. yellow pine timbers and 7½ x 8-in. ties. These bolts have square heads and washers set into the timber and the hole is filled with pitch. A reinforced concrete drain pit, 4 ft. square, delivers the water from a gutter around the center bearing to an 8-in. cast-iron drain pipe. The ash pit is built of reinforced concrete with granite paving on the bottom and lined with firebrick to protect the concrete from the action of hot ashes. A gantry crane and clam-shell bucket will be used to transfer ashes to cars.

The roundhouse is part of a group of proposed buildings to include in addition a 1,500-ton coal pocket, a sand drier, an auxiliary 75-ft. turntable and a water tank, as shown in the location plan. The present contract includes the 55,400-gal. water tank and it is now under construction. Foundations for this tank were laid on 45-ft. piles projecting 6 in. into the 1-ft. cap, the cut-off point being at 0.0 elevation. The reinforced concrete tower consists of four columns 16 in. square under the center and eight smaller columns, 14 in. square, spaced evenly around the outer edge. The outside columns are rigidly connected by horizontal braces around the bottom and at the middle point, while the reinforced concrete floor system serves to stay the top. Diagonals 9 x 12 in. in size are used as lateral bracing for the four interior columns. The floor slab is 9 in. thick and 30 ft. 9 in. in diameter with the upper surface at El. 45.25. Reinforcement of the slab consists of ½-in. square twisted rods, 4 in. center to center, laid in both directions in the upper part of the slab. The slab is supported by beams, 1 ft. 2 in. x 2 ft. 6 in. in dimensions, measured to the top slab and running diagonally across the bottom between columns and also a large beam around the outer edge between columns. All concrete above the tops of the piers, El. 7.5, is a 1:2:4 mixture and below this elevation a 1:3:5 mixture was used. The columns are reinforced with two old third-rails bolted back to back with ¾-in. bolts about 3 ft. apart and fastened with two old fish plates where they break joints. These old third-rails weigh about 95 lb. per yard and are wound every 3 ft. with three turns of ⅛-in. wire. The bottom of the slab and girders is reinforced with corrugated bars bent up over the supports to provide for negative bending moment and shear. The tank itself is constructed of wood and has an outside diameter of 24 ft.

With the exception of 1⅞-in. lumber used for columns and beam bottoms all forms are built of ⅞-in. stock. The column forms are securely tied by 4 x 4-in. wood collars bolted together and spaced about 3 ft. on centers vertically. Because of the treacherous soil around the building the column forms and roofing forms are shored up by a large number of old steel rails laid on the upper surface of the engine-pit foundations. Forms are fastened with double-headed nails, the second head projecting about ¼ in., giving a good hold for a claw hammer, and it is said that this method effects a great saving of time in taking the forms apart.

A 1:2:4 mixture of concrete of medium wet consistency is used in the superstructure of the roundhouse, while a 1:3:5 mixture is used for foundations. The engineer in charge is having a complete set of crushing tests made on all concrete. Six-inch cubes, of each day's pouring, are made at the building in steel forms and forwarded to the testing laboratory of the railroad. Tests are also frequently made on the sand to ascertain the percentage of foreign matter. Cubes of the 1:2:4 mixture show an average crushing strength of 1,570 lb. at ten days and 2,740 lb. at thirty days, while the 1:3:5 mixture tests at 930 lb. and 1,890 lb. respectively.

Giant Portland cement is being used in the roundhouse proper and Alpha Portland in the foundation of the outer turntable. The reinforcement consists entirely of square twisted rods with the exception of the 2½-in. roof slab, which is reinforced with Clinton wire cloth. Trap rock from Middlefield, Conn., and Wallingford sand are used for the concrete. Economy double-headed nails, made by F. A. Neider Company, Augusta, Ky., are used in all form work.

The preliminary work began last fall, but it was not until May 1 that the building was actually under way, since which time a force of about 250 men has been employed and the work is now being rapidly pushed to completion in order to be ready for occupancy this fall. A cement shed, with a capacity of four carloads, is located near the mixer, while sand and crushed rock are shoveled from freight cars onto piles alongside the industrial tracks, from whence they are conveyed by Orenstein-Arthur Koppel Company cars to a 30-ft. Ransome bucket elevator and hoisted by a double-drum engine to bins above the mixer. This engine also operates the cement elevator, which runs up to a platform above the mixer hopper, where one laborer feeds in the required proportions of cement. All concrete is mixed in a No. 2 Ransome mixer and distributed to the different sections of the work in a 30-ft. Lakewood car operated by an endless chain over a wood trestle, about 20 ft. high, which is built from the elevator at the mixer stall, over the center of the turntable, to a similar elevator at the opposite side of the clear area. One Ransome and one Insley 30-ft. bucket are used in the elevators, which extend up to the roof. The car and Ransome bucket are operated by the engine shown near the mixer, while a separate engine is used for the Insley bucket. Concrete is dumped from the car into the feeding hoppers when the elevator is down and is pushed in 6-ft. Ransome carts to any section of the building. These carts were run inside the covered ring on a low trestle when casting the pits and foundations, while for the roof itself and the columns the carts were run on boards placed on the roof. By the above arrangement an average of 100 yd. of concrete is laid in a day. It is stated that at favorable points 27 yd. have been laid in an hour. All columns are cast with the roof and are tamped with a long wooden pole having an iron point, care being taken not to displace the reinforcement. Steam for the entire plant is furnished by a 125-hp. marine boiler.

The Cedar Hill roundhouse was designed by the engineering department of the New York, New Haven & Hartford R. R., Mr. E. H. McHenry, vice-president; Mr. Edward Gagel, chief engineer; Mr. H. L. Ripley, engineer of construction, and Mr. J. M. Sullivan, Jr., assistant engineer in charge of the work. The general contractor is F. T. Ley & Company, Inc., of Springfield, Mass., Mr. W. G. Smith, superintendent.

Plans are being made by the Northern Electric, it is reported, for putting up a new passenger station at Oroville, Cal. The estimated cost of the station is $12,000.

George B. Swift & Co., Chicago, Ill., have been awarded a contract to build a 9-stall roundhouse at Sidney, Neb., for the Union Pacific.

The Pennsylvania announces that the company will proceed at once with the preparation of plans for the construction of a modern grain elevator at Girard Point. The new elevator will be of concrete, and, including the concrete grain bins attached to it, will have a capacity of 1,000,000 bushels. Grain driers, with modern machinery for the proper care of grain, will also be provided.

The Southern Pacific proposes to erect a new double track steel bridge at Niles, Cal., crossing Alameda Creek at that point. The structure will cost $50,000 and will be 200 ft. in length.

The Southern Pacific, it is understood, will build a terminal at Brooks Island, at the southern end of the city of Richmond.

NOTES ON PILE PROTECTION.*

In the course of some wharf construction for the Guatemala Ry. in Puerto Barrios, Guatemala, it became necessary to deal with some creosoted southern United States piles which had been in place for about seventeen years. These piles were nearly all of them in fair condition excepting at and near the water line, but at this belt for about five feet in width, most of them were badly eaten, many having cavities extending completely through them, the result of the combined activity of the teredo and the limnoria. The expense of replacing these piles with new ones would approximate fifty dollars each. The incentive for saving them by placing some reinforcement was so great that the writer gave much time to its consideration.

The first idea was to place such reinforcement by using a chamber clam-shell like, each half of which should have a semi-circular opening in the parting line of the bottom for embracing the pile when clamped about it, and which would admit a workman after unwatering the chamber, the annular space about the pile being first calked. A test chamber was made, but trials in controlling it against the effect of even a wind-chopped sea of moderate force proved the futility of rapid and economical manipulation and the idea of working in the dry was abandoned. Had the apparatus proved successful it was proposed to place a reinforcement of nails, poultry netting and cement mortar, similar to that hereinafter described for protecting some of the piles which were placed in the new construction.

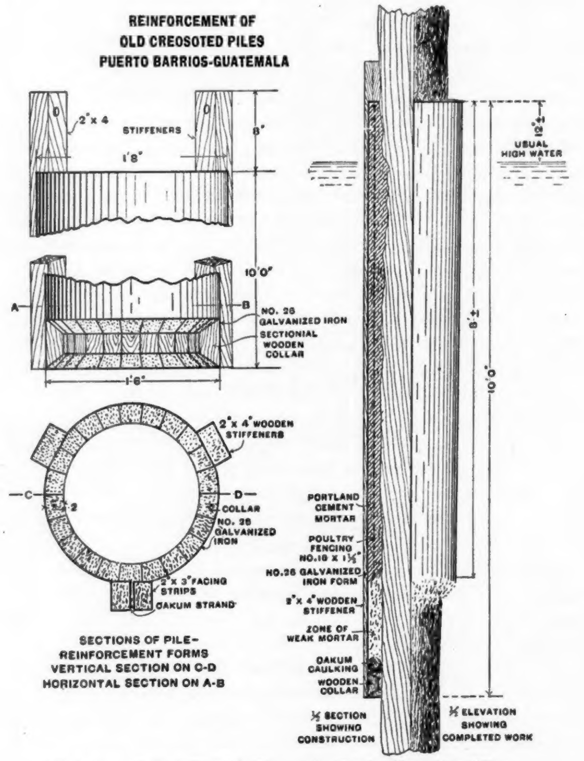
Next, forms were prepared for placing in the wet about the old piles a reinforced cement-mortar envelope, which should have a width of about 8 ft. and a minimum thickness of 2 in. These forms were made of No. 26 gage galvanized iron made into cylindrical shape with a slight taper and 10 ft. in length. A 2-in. by 3-in. strip of pine having a length of 8 in. greater than the form was attached on each side of the parting line, which was up and down. The metal was folded about the strip an inch on to the three-inch side, leaving two inches for attaching an oakum strand, which was needed to prevent egress of mortar. Two 2-in. by 4-in. stiffeners of same length as the facing strips were fastened to the form at the one-third point as shown in the cut, Fig. 1. A collar of 2-in. stock made from narrow blocks was provided at the foot to serve as a gage for regulating the thickness of the mortar, as well as serving to calk against in closing the foot against the escape of the mortar.

The mortar envelope was reenforced by a wrapping of poultry fencing of No. 16 gage with 1½-in. mesh. The procedure was first to scrape off the mussel growth on the pile to be treated. This growth forms a complete mat but is detached quite readily. The poultry fencing is then put in place. This is made up into a roll, 8 ft. long, and having enough fullness to lap on to itself several inches when placed about the pile. The form, nearly buoyant with the stiffeners, is then floated into place, first having been provided with a wreath of fluffy oakum affixed to the collar. The facing strips are closed tightly with carriage clamps hung from them by cords of such length that when the clamps are squared into horizontal position they are in the proper place for screwing up by the divers. The divers are naked, and their further duties are to close the bottom of the form effectually against the egress of the mortar, watching carefully that none is escaping at the time of the filling. Steel bars 8 ft. long of ½-in. stock are hung, one in each of the three sections of the form. They have a shepherd's crook for support on the top edge of the form, and are used for slushing the mortar into compact state as it fills.

The mortar is made one part cement to about two parts sand, the latter being silica and selected as coarse as possible, say 0.18 mm. effective size. It is assured that there is a little overfill of cement. The operation of filling is carried on rapidly, the effect of the slushing rods being supplemented by tapping with clubs on the stiffeners, resulting in securing a sound mass excepting in the lower zone of about eighteen inches.

It will be noted that the forms were made 2 ft. longer than the reinforcement cage. The separating of the sand from the cement in the lower portion could not be avoided under the limitation of having to drop the mortar through so great a depth of water; accordingly the reinforcement was made to occupy only the sound part of the envelope.

Fig. 2 shows the construction and the finished appearance of the work. At the time of writing the work is still in



Details of Reinforced Concrete Protection for Piles.

progress, with a record showing no failures. It should, however, be added that at times much delay is caused by difficulty in sealing the foot of the form. It is useless to place the mortar when any is escaping at the bottom.

The expense of this treatment is—labor (contract price), $8; materials (cement, fencing, etc.), $4; a total of $12, to which should be added the expense of experimenting and overhead charges. There seems good reason to expect a further life of the piles thus treated as great as that at present sustained.

Protection of Piles Before Driving.

There was also used experimentally on some of the creosoted piles in new construction in the same work, a reinforced mortar protection applied in the following manner. First, wire nails—about 12d.—were driven thickly over the protected zone for one-third their length, the zone being 10 ft. wide; next, the nails were bent over, using in this operation a short length of small iron pipe, which was not only

*Read before the Boston Society of Civil Engineers by T. Howard Barnes.

expeditious but prevented the nail from making the angle close to the wood; a wrapping of poultry fencing of the before-described class was then attached; a coat of Portland cement plastering was then applied, being thoroughly troweled in; this was about ¾ in. thick and was treated when set by a grout wash of Portland cement mixed in a solution of water glass. The envelope was kept wet until well set. In respect to the water glass it is too early to note its effect in resisting the action of sea water.

The driving of these piles showed the following features of interest, the hammer used being a regular drop hammer weighing 2,500 lbs. Confining the drop to 4 ft., the envelope was nearly invariably kept intact; above this limit of drop the mortar was detached more or less, the detachment occurring nearly aways at those places in the envelope where the fencing was in contact with the wood; the mortar was also weakened and became detached through the influence of the creosote which had cooked out of the pile and permeated the mortar as it lay in the yard exposed to the direct sun rays.

The cost of this form of protection was—labor (contract), $1.20; materials, about $2.50; a total of $3.70, exclusive of overhead charges. It must also be observed that the handling cost in placing the piles in the yard in position to be treated was additional and amounted to a considerable item. This expense applied, of course, in the case of any desired treatment, such as coppering, etc. More care in dragging out the above-described poles over the ground from the yard was actually required than in the case of those protected with copper yellow-metal. The expense of yellow-metal covering in 20-oz. weight was three times that of the mortar protection.

Conclusions.—If the netting be placed so as to be free from contact with the wood, leaving a clear space of about ¼ in. for the mortar to enter and get a grip of the wire, ordinary handling with careful driving will not injure the envelope; certainly the use of a steam hammer would insure entire freedom from damage in driving. When applied to creosoted piles there should be maintained a shade to prevent the exuding otherwise of a serious amount of creosote under the heat of the direct sun rays.

It may anticipate some reader's query, "How do you account for the confining of the activity of the sea pests to so narrow a belt?" to remark that the clearness of the water seems to govern the activity of the teredo and of the limnoria. The Puerto Barrios harbor bottom is a mineral ooze, very easily stirred up. Other localities, like Port Limon in Costa Rica, having clear water to the bottom, show an activity of the borers, which, while greatest at the water line, extends to the ground, and the limnoria has been active enough at depths of 25 ft. to eat off creosoted piles in seven years.

Local conditions of murkiness of water may account for curious differences of such activity in neighboring wharves which the writer has had cited to him as occurring in our northern waters.

DOUBLE TRACKING IN THE ROCKY MOUNTAINS.

An important piece of railway construction has been finished by the Great Northern, which double tracked fourteen miles of its main line from Java to Summit, Montana, at the very crest of the Continental Divide, in the heart of the Rocky Mountains. The work, which cost $1,500,000, was begun October 1, 1909. During the two years it took to do this work there were as many as 1,500 men on the job at one time and never were less than 500 engaged.

Not only has a double track been built, but the old line practically was rebuilt in order to reduce curvatures and improve the grades. A striking illustration of the reduction of curvatures is shown by the fact that in taking out the curves in the old line the new track has crossed the former route fifty-eight times in the fourteen miles of construction.

The contract called for 1,000,000 yards of grading and 300,000 yards of ballasting. Two large cement tunnels were made between Fielding and Highgate, and numerous cement culverts were built which are large enough for the smaller sized passenger locomotives to pass through.

The old grade was raised from one to six feet, making an even grade of 1.8 from Java to Summit. Four heavy curves were eliminated within a distance of one mile, near Fielding. West of the town of Skyland there is a cliff of rocks extending 500 feet back from the tracks, of such formation that had it been blasted it would have resulted in a slide that would tie up traffic several weeks. In order to overcome any danger from this threatening tower of rocks a mammoth cement retaining wall was built.

The Great Northern's yards at Java, Fielding and Summit were changed completely as the result of this new construction work and at Highgate and Skyland the side tracks were extended 800 feet. New depots were built at Java, Fielding and Summit and water tanks of the most modern type were built at Summit and Fielding. The bases of the tanks stand 30 feet from the ground and are located fifty feet from the tracks, the water being piped underground to standpipes near the tracks. There are two of these tanks in each of the towns named.

Two miles east of Java it was found necessary to cut 1,000 feet through solid rock fifty feet high. This was an expensive piece of work, especially since the river channel, which follows the road bed, had to be changed in several places to protect the grading.

In this construction work the triangular tie, a patent of James J. Hill, Chairman of the Great Northern Railway, was used. Ninety-pounds rails, with Goldie tie plates and Wolhaupter joints, were laid, one-inch bolts and six-inch spikes being used.

This double tracking is of great importance to traffic over the Great Divide of the Rocky Mountains. It saves four hours in the time of east bound trains, while the improved grading enables passenger trains to make better time over what was previously the most dangerous and slowest piece of track on the division.

It is not the intention of the Great Northern to stop with the completion of this work. The company's engineers already have plans to continue the double track from Java west as far as Columbia Falls, a distance of forty-five miles. The new system of ballasting will be continued as far west as Stryker. Besides the double tracking the Great Northern has had a small army of men at work reballasting the main line from Summit to Cut Bank, making practically a dustless road-bed. Thirteen miles of new steel was laid along this stretch over the new ballast.

G. D. Eddy, chief engineer was in charge of the work. Division Roadmaster J. Garrity and his assistant, F. A. Larson, superintended the track laying, with Division Superintendent W. R. Smith over-seeing the undertaking.

The Louisville & Nashville is contemplating building a new passenger station at Pensacola, Fla. Tentative plans are being prepared, but definite action has not been taken.

The Minneapolis, St. Paul & Sault Ste. Marie has let the contract for building a new passenger station at Rhinelander, Wis. The structure will be of brick, one story high, with limestone trimmings and slate roof, and will cost approximately $25,000.

A bridge is to be constructed by the New York, New Haven & Hartford over the tracks at Ferry street, in the city of New Haven, Conn. The structure will be of concrete, 50 ft. wide and 135 ft. long.

THE WELCOME MAN.*

By Jno. J. Baulch, Supt. Manufacturers' Railway, St. Louis.

In looking around for a title to a short paper for the vacation series and having in mind a promise made to the Club for this "filler," which, in some measure, should be a discussion of Col. R. V. Taylor's fine talk at our March meeting, I ran across the following and at once decided to use the title and also the words as a part of the article, it being to my mind in full accord with Col. Taylor's expressed sentiments of "The Railroad Man":

"There's a man in the world who is never turned down, wherever he chances to stray; he gets the glad hand in the populous town or out where the farmers make hay; he's greeted with pleasure on deserts of sand, and deep in the aisles of the woods; wherever he goes there's the welcoming hand—he's The Man Who Delivers the Goods. The failures of life sit around and complain; the gods haven't treated them white; they've lost their umbrellas whenever there's rain, and they haven't their lanterns at night; men tire of the failures who fill with their sighs the air of their own neighborhoods; there's a man who is greeted with love-lighted eyes—he's The Man Who Delivers the Goods. One fellow is lazy, and watches the clock, and waits for the whistle to blow; and one has a hammer, with which he will knock, and one tells a story of woe; and one, if requested to travel a mile, will measure the perches and roods; but one does his stunt with a whistle or smile—he's The Man Who Delivers the Goods. One man is afraid that he'll labor too hard—the world isn't yearning for such; and one man is ever alert, on his guard, lest he put in a minute too much; and one has a grouch or a temper that's bad, and one is creature of moods; so it's hey for the joyous and rollicking lad—for the One Who Delivers the Goods!"

The rank and file of the St. Louis Railway Club are and have been "welcome men" and when Col. Taylor voiced his loving, kindly remembrances of his lifetime friend and companion, Col. E. L. Russell, there were many responsive hearts in his audience, for we had known Col. Russell as "a welcome man," "a railroad man," and a friend in the fullest acceptance of the term—and, as we look over the pages set apart to the memory of those "who have gone before" we find the names of many "a welcome man." There is not much room for discussion of Col. Taylor's address. It is full of strong argument, delicate sentiment and timely advice, the voice of a practical worker high up in the councils of the company he represents and in the railway service. We can only absorb it—and follow its precepts and his example—and by doing so "deliver the goods." How few there are outside of the rank and file of railroad men who appreciate the necessary qualities that make for success in any branch of railroad work.

Col. Taylor says: "First, courage; second, intelligence; third, honesty; lastly, industry." Not much can be added. The truly "welcome man" is punctual, indefatigable—a graduate of the university of hard knocks, who has "cut the grump and the grouch and got onto his job," knows the detail, turns it over to others and solves big problems, and smiles the while—and

"It's easy to laugh and be happy
When life moves along like a song,
But the man worth while
Is the man who can smile
When everything goes wrong."

for there are days when this strenuous railroad work seems to go all wrong—nothing right from general manager to office boy—then it is that the "railroad man" shows his courage and ability, smiles at his troubles and fights and works his way out of his difficulties, weathers the storm and can sit back and feel that he has accomplished something. Speaking of general managers and office boys—Mr. Joseph Ramsey asked me once if I ever abused my messenger boys. A negative reply brought the remark: "Don't ever do it, you don't know how soon he may be a general manager," and we all know that Mr. Ramsey is a "welcome man."

Commencing with the messenger boy. A doting parent and fond mother conceives the idea that although a failure in several ventures he is surely the making of a railroad man—it's so easy, you know, and Tommy is easy. Papa brings him in, discourses on his ability, says Tommy is a fine boy, eighth grade, very smart in school, and so you take him on. In a few days you are going over the yard, here comes your fledging with a pipe stuck in his face and a cheap novel in his pocket—meandering along—forgets to say good morning—his thoughts anywhere but on his work and then you give him some attention. His time and mind is occupied in absorbing all of the gossip of the crossing watchmen, he attends all the "ash pile" and "end of the tie" conventions, and assumes to arrrange the policy of the company from that direction; he seems

"To have arrived from the town of No Good
On the banks of the River Slow,
Where lives the wait-awhile flower fair
Where the some time or other scents the air
And soft go-easies grow."

"It lies in the Valley of What's the Use
In the Province of Let Her Slide;
The tired feeling is native there,
It's the home of the reckless I Don't Care
Where the give-it-ups abide."

The quicker you take that young man in, give him some strong, fatherly advice, which, if he is the right kind of a boy, will change his methods—if not he should change his business abruptly and absolutely. But there are many bright boys who are coming along to take our places with all the characteristics quoted by Col. Taylor, who keep a sharp lookout for the work in hand, who do not require constant watching and who in the near future will not only be able to do their own work well but to assist in and finally direct the efforts of another and then others, and, as has been aptly said, "The more people he can direct and the higher intelligence he can rightly lend, the more valuable is his service."

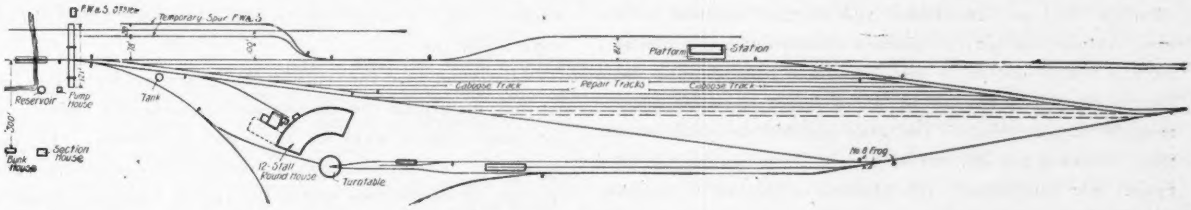
Add to this a superlative degree of enthusiasm and we have the "welcome man," who in the fullest acceptance of the term can "deliver the goods." It may be he will not please everybody, but some writer says, "'twould be awfully monotonous if we could please everybody," and again, he will make mistakes. Elbert Hubbard says: "The man who never made a mistake never made anything else worth a d——."

*Presented before the St. Louis Railway Club.

NEW YARDS, EDSON, ALTA.

The divisional yards of the Grand Trunk at Edson, Alta., are practically completed, and comprise approximately 10 miles of yard tracks and 6 miles of lead, repair and coaling tracks and wye. The passing sidings, main leads and frogs are laid with 80-lb. rail, the balance being laid with 60-lb. rail. The design for the yard is ten parallel tracks of equal length, the middle three being utilized for repair and bad order tracks, thus dividing the yard into east and west bound yards. Future extension will be secured by duplicating the ten tracks east of the present ones. The following buildings and facilities have been erected: 12-stall engine house with machine shop and 75-ft. turntable; coaling plant of 1,000-ton capacity with inclined trestle approach; car repair shop, 250 ft. in length, 50 ft. in width and covering three tracks; elevated water tank, 50,000 gallon capacity, with necessary gaso-

line pumping engine, etc. In connection with this water tank a substantial dam on the west end of the yard 350 ft. in length and flooding an area of 10 acres to an average depth of 4 ft. has been provided to secure an adequate supply of water. A two-story modern depot with ample offices for the various divisional officers has also been constructed. The slope or grade of the yard is very slightly to the south and east.



Grand Trunk Pacific Yards, Edson Alta.

FREIGHT TRANSFER STATION, PENNSYLVANIA R. R.

It would be too much to suppose that bulky freight will ever be handled as rapidly as are the mails, but through the perfection of methods and facilities—the employment of scientific management in transfer yards—the railroads are aiming towards such rapidity, and at the same time working wonders in economy.

A clerical force of 210 and a warehouse force of 249 are kept busy at the Waverly, New Jersey, transfer station of the Pennsylvania, where last year over 100,000 cars of freight in less than solid car lots were received. The contents of these cars were sorted into solid car lots and sent to hundreds of destinations. The result of their labor was a saving of 11,352 cars in the performance of the business and an incalculable amount of time to thousands of shippers. This station is situated between Newark and Elizabeth, New Jersey. Into it cars are fed from thirteen transportation companies, two terminal companies, and the docks of New York City, and also freight from Jersey City and Newark. During rush seasons as many as 700 cars are taken care of in a day.

As an illustration of the working of the transfer system, suppose a car loaded with freight originated in a small town in New York State destined for fifteen other towns throughout the United States. The car would be rushed to Waverly, where its contents would be consolidated with other shipments to the same fifteen towns or to another transfer near those that were too small to command a solid car from Waverly. The freight that is handled in this way is called preference freight, and the trains that carry it run on schedule with the same precision and almost the same speed as passenger trains.

The transfer platforms at Waverly afford standing room for 212 cars. On certain tracks the outbound cars are lined up empty. The loaded inbound cars are ranged on the opposite sides of the platforms and their contents are transferred to about 250 cars, which are despatched directly to 121 different points daily.

The system is worked out so well that the transferring is carried on with the greatest precision and celerity. Beside each outgoing car there is a number and a box containing little squares of paper bearing the same number. The checkers in charge of unloading are provided with waybills for each piece of freight. They also have a chart showing the positions of the outgoing cars and their numbers, which represent the places they are to be sent. As the articles are removed he checks off on the waybills. He then turns each piece over to a truckman, together with a slip of paper on which the number of the car that is to receive it is written in pencil. The latter, when he has deposited it, takes one of the ballots out of the box. This should bear the same number as the one given to him by the checker and he is required to bring them both back to show that he has made his delivery at the right place. Waybills are made out for the new cars, which are pulled out to make room for others as fast as they are complete.

This is the work that is performed by the warehouse force, but the clerical end of the business is far more complicated. Besides the waybills, of which 3,500 are sometimes made in a day by a force of 52 clerks, there is the accounting to be done. Divisions of earnings and settlements must be made with fifteen outside companies. The method of keeping track of what the company owes to and is owed by the other companies for handling freight is similar to that employed in a clearing house. In addition to the warehouse force which is occupied directly with the transfer of freight, eight distinct departments are required to look after the details of the transference, as follows: A Pennsylvania R. R. accounting department, a Union Line accounting department, separate departments for east and west bound waybills and car records, a tracing department and a transfer record department.

The Waverly Transfer was opened in September, 1904. At first it was planned to handle only the freight from the New York, New Haven & Hartford and the Long Island and the capacity was 96 cars. After six weeks it became necessary to employ day and night shifts to keep up with the business. The station was soon enlarged to accommodate 200 cars and later its capacity was increased to 212. Illustrative of the transfer's rapid growth is the fact that the tonnage for less than carload lots has increased nearly twofold from 1905 to 1910, and the total tonnage has more than doubled in the same period. The number of inbound and outbound cars has grown in like proportion. The difference between the number of inbound and the number of outbound cars represents the saving made by handling the freight in solid car lots. This difference amounted to 10,872 cars in 1905 and 11,352 in 1910.

That greater economy in the matter of car mileage is being generally practiced by the railroads is indicated by the increase in average load per car received at the transfer, from 5.67 tons in 1905 to 6.33 tons in 1910. Of course, these figures also bear some relation to increased business, which makes it possible to load more heavily. From the beginning there has been a great saving in all mileage at the transfer, the outgoing cars carrying an average load of 6.44 tons in 1905 and 7.42 tons in 1910.

The Lackawanna plans to construct a concrete bridge across the Tunkhannock Creek in Wyoming County at Nicholson, Pa. The plans for the bridge, which is to be 2,700 ft. long, call for 240-ft. arches, to be 235 ft. above the creek. When completed this will probably be the largest concrete bridge in the world.

The State Railroad Commission of Indiana has ordered the construction of five railway stations as follows: One by the Cincinnati, Hamilton & Dayton, and another by the Chesapeake & Ohio, at Cottage Grove; the Lake Erie & Western and the Grand Trunk joint station at Stillwell; Vandalia Railroad, at Macksville, near Terra Haute, and the Chicago & Erie, at Bippus.

The Louisiana & Arkansas is planning the construction of bridges in Arkansas in connection with proposed extension of its line from Mena, Ark., to Vidalia, La.

CONSTRUCTION OF SWITCHES.

A matter of first importance in laying switches is the proper distribution of material; this is even more important here than in other track construction on account of the number of different parts, the absence of some of which may seriously delay work.

On account of the many small but important details which must be attended to in laying switches such work should be intrusted to an experienced foreman. More careful supervision is necessary than in other track work, and unless good intelligent men are obtainable for assistant foremen, it is advisable to keep the gang small enough (say 20 laborers) so that the foreman may oversee all the work himself. In laying ladder tracks it is possible to advantageously handle a gang of 40 to 50 "hobo" laborers with one assistant and a "handy" man. The general run of foreign laborers requires constant attention to prevent them spiking down a switch point, setting a switch stand with the lever in the wrong position, or doing other wrong work which detracts from the quantity and quality of work accomplished.

There is an advantage in working foreign labor, if men of some skill and experience and a good assistant of the same nationality can be otbained; foreigners generally stay on a job and the same men can be depended upon from day to day. When working "hobo" labor it is not uncommon for 25 per cent of the gang to quit the work at one time. After a pay-day hardly any of them can be depended upon. For this reason it is practically impossible to regulate a gang of "hobos" to a desired size. It is generally safe in sending an order for this class of men to a labor agency, to order at least twice as many as actually needed; that many men will frequently drop off before reaching the job. If American labor is to be had it will generally prove to be best for work out on the line. In the larger cities it is generally necessary to use foreigners; this is partially due to the fact that many large cities prohibit railway camps within the city limits, and these are practically indispensable for "hobo" labor.

American labor is more easily handled at points out on the line. A gang of foreigners becomes a small union in isolated places, and the discharge of one man is likely to cause a strike of the entire gang. In large cities foreign labor is easily replaced and the same tactics cannot be employed.

Putting in Ties for Switches.

Before stripping out the ballast the location of the point of switch, the heel of the frog and each joint should be marked on the rail. The marks of the ends of the switch should be given first, to prevent unnecessary excavation.

Ordinary track ties may be used for temporary switches in case of a shortage in switch ties. These must be interlaced between the old main line ties in such a manner that the curved rails of the turnout may be spiked to them.

When interlacing in short ties two tie lines should be stretched, or a mark made, approximately 6 inches beyond the line where the ends of the ties will come, and ballast should be removed only to this line. Digging out ballast clear across the main track means useless labor in excavating and later replacing ballast.

When stripping out for a set of switch ties, ballast should be removed at least 6 inches beyond the ends of ties, but no more ballast should be removed than necessary to accommodate the switch ties, and permit of their easy installation.

In removing ballast for any purpose, the depth excavated should not be more than one-half, or at most one inch below the bottom of the ties. An unnecessary depth means a waste of labor in removing and replacing ballast, and an unnecessary softening of the track foundation.

Uniform spacing for center of ties should be laid off so that a tie will come at each joint slot, and so that the standard number will come under the rails, switch rails and frog. These space marks should be made on the web of the rail, so they will not be removed by passing trains.

After the ballast has been stripped out from between the track ties, the switch ties should be spread out in the exact order of their lengths, and, if possible, directly opposite their proper positions, at right angles to the track. Then, when the track is raised, the ties may be easily launched endways under the rails.

The method used for replacing the track ties by switch ties depends mainly on the amount and frequency of trains over the track. Three ways are suggested as follows: (1) The spikes are withdrawn from a number of consecutive ties, or from all of the ties within the switch location. Starting at one end of the switch the rails are then lifted with the jack, all of the old ties removed and the switch ties put in, in proper order and approximately to correct space. As soon as the jacks are moved to another position, a few ties may be spiked and the track gaged. The jacks are moved along until the entire set has been installed. This method is not advisable where trains are heavy and frequent, as trains are liable to be delayed. (2) The spikes on every other tie are withdrawn. Jacks are then placed, the track raised, and the unspiked ties are removed. The whole set of switch ties is pulled into the space between the remaining track ties. The spiked track ties will hold the track to gage and fair surface, and a train may be passed at any time at reduced speed, for as soon as the jacks are removed the track again settles down to the original grade, if care has been exercised in stripping out the ballast. The switch ties will, of course, lay close together, but it is generally found possible to get about one-half the switch ties at their proper spaces, and enough of them are spiked to hold the track to gage. Immediately following the spikers are men with claw bars who pull the spikes out of the old ties which remain. If any rails are to be moved when the switch is installed, spikes along these rails should not be driven down tight, but should be left a little loose to permit of easy removal. The remainder of the old track ties may be removed when enough switch ties are spiked to make the track safe; the roadbed is leveled off and the whole set of switch ties properly spaced. (3) Short ties may be replaced, a few at a time, by switch ties in the same manner that track ties

are renewed. This is the most costly method, but the track can be kept safe for high speed trains.

The second method keeps the track safe for trains at reduced speed at any time, if the work is followed systematically from one end of the switch to the other. By the time the first half of the track ties are removed the spikers have enough switch ties spiked to allow the jacks to be placed behind them without any delay. This method is safer and causes less delay to trains than the first; is cheaper than the third; and allows the efficient use of a large gang which, of course, gives increased speed in the accomplishment of the work.

Before raising the track to remove ties, the spikes should be raised on six or seven ties ahead of any behind the switch, high enough to prevent these ties being lifted off their bed; if this precaution is not taken these ties will be lifted and ballast is liable to run under them, spoiling the surface of the track.

Temporary Switches.

There are several disadvantages in using ordinary track ties interlaced in building a temporary switch. A great deal of difficult adzing is necessary with hewed ties, in order to get a rail bearing for each rail on the ties. Even if sawed ties are used throughout, warped ties will require adzing. A further and greater disadvantage is that the ties will generally be so closely interlaced that it is practically impossible to do any surfacing, or tamping.

A temporary switch should be located in a manner which will necessitate the least disturbance of permanent track or other structures, in order to facilitate the replacement of these structures.

Track joints must not come between the point and heel of the switch rails, for if they do the switch points will not fit up against the rail. The location of a temporary switch should, if possible, be such that no track rails will have to be moved transversely in order to make the joints clear the switch point; for in addition to the increased amount of work necessary, a rail must be cut and two short pieces used in the main track instead of one. Also when the temporary switch is removed the track is again made continuous by inserting the rails previously used, no cut pieces or transverse movements of the rail being necessary.

Having decided on the proper location of the frog point, the switch should be laid out, i. e., the location of the switch point and rail joints marked on the existing rail. It is well to bear in mind that considerable variation of the switch lead (say 10%) is allowable and advisable in temporary work if the work is facilitated or the number of cut rails can be reduced.

If the frog and switch points are new, only new rails should be used for lead rails and against the heel of the frog. However, if the main track rails are not worn down or battered much (in other words, if they are practically as good as new) they may be used anywhere in the switch. A worn rail placed against a new frog, or vice versa, makes a bad joint and spoils the frog or the rail.

In laying temporary switches it is generally possible and advisable to omit heel blocks, frog blocks and guard rail blocks with the possible exception of those on the guard rail for the curved lead. Frequently it will be unnecessary to drill cut rails, as a sufficiently strong joint can be made if there are two bolts in one of the abutting rails. If the cut rails are drilled, one hole should be sufficient. Slide plates may be lacking to complete the set for a temporary switch. The number necessary may be reduced one-half or more with safety if light engines and slow speeds are to be used.

The method of putting in the switch points, lead rails and frogs of a temporary switch does not differ materially from the method for putting in permanent turnouts, described below, except that the quality of the work need not be so high.

The No. 1 or adjustable rod furnished for a temporary switch is likely to be an old one, and the adjustment is liable to be badly rusted, especially if the rod is one of the old type with screw adjustment. It may be impossible to adjust such a rod; it would usually be permissible for a temporary switch in a side track to use a rod which would force the track at the switch points somewhat out of gage, in case the tendency is to make the gage wider. Narrow gage is unsafe at a switch point, as the wheel flanges are more liable to climb up on a switch rail than on ordinary track rail. If the switch rod will not make the gage at the switch point more than about one-half an inch wide, the following method for setting a stand may be used with a switch rod which cannot be adjusted. Connect up the switch stand, connecting rod and No. 1 rod; throw the point against the stock rail with a bar and spike it in this position, having previously spiked the No. 1 switch plate in place on the same side. The switch stand should now be lined up parallel to the track with the target showing correctly, and the handle in its correct slot for the given position of the switch points, and spiked solidly in this position, taking up all lost motion that will affect the operation of the closed switch point; the spike holding the switch point is now removed and the opposite point thrown over against the unspiked rail, the handle of the switch stand moving at the same time far enough to drop into the next slot; the track rail should be held tightly against the switch point and spiked in that position at the same time, inserting the other No. 1 switch plate, and making sure that the spike on the opposite rail is well up against the stock rail. The switch points will now close on either side, and although the gage will not be exact it will be close enough for temporary work. The remaining switch plates may be placed without gaging, after gaging at the heel of the switch rails. After putting on slide plates on one end the switch ties are liable to move lengthways and the spikes drop off the rail, when spiking the opposite end. To prevent this provide two nippers and nip the spiked end of the tie up first.

It is a very difficult matter to procure men who will not take too much pains with temporary work. This is true of nearly all vocations; an artisan or workman who takes pride in his calling dislikes to leave an inferior piece of work behind him, even though it be done well enough to fulfill all requirements. No argument is necessary to show that a

piece of work which is to last two or three months should have less time spent on it than one which is to remain for years.

Laying Turnouts in Main Line.

Turnouts or crossovers generally can be put in without delaying traffic, if the proper method is used. Even when the time available between trains is only 15 or 20 minutes the work can be done with a fairly intelligent and willing gang without delaying regular trains. Very thorough and systematic preparation is necessary, however, in a case of this kind.

First Method—With standard 33-foot rails the easiest method of putting in a No. 10 or No. 11 turnout is to use two of the existing track rails for the tangent or main line lead. This length of rail with a frog 15 feet long (toe from 8 to 9 feet long) and a 15-foot switch rail makes a good lead, and eliminates cutting for lead rails.

The switch, when using the method to be outlined, must be located so that the frog will toe-in against one of the main line rails. This kind of a location is generally permissible in a turnout or one end of a crossover, but not in the opposite switch of a crossover, as the latter must be arbitrarily located so that the rail between the frogs will line up correctly.

The rails on the straight or main line side of the track will not have to be removed (if the rails are the same size and weight as the switch and are in good condition) unless a rail joint will fall beside a switch rail. In the latter case the rails must be moved longitudinally so that the joint will not interfere with the switch rail. This means that two short rails will have to be used. These two pieces may be made with one cut. A rail is selected the same length as those in the track. By measuring with the tape line, the proper distance to move the joint ahead is determined, and a piece of rail of that length cut from the standard length rail; then, when one of the track rails is removed and the rails slid ahead against one of the cut pieces, the remaining piece will just fill the hole left behind the rails moved. In order to get the joint ahead at least two of the track rails will have to be moved. It may be policy to move more rails than this, for it is advisable that no joint be located beside a guard rail. This fact should be taken into consideration when figuring on the longitudinal movement. After the short rails are cut, flagmen are sent out for protection and all the spikes are removed from one side of the rails to be moved. Part of these spikes can be removed during the preliminary work. Two joints ahead of the switch will have to be broken and the rail removed where the short rail will come. Another joint will have to be broken back of the rails to be moved. The short rail is then placed in the track where the rail has been removed; the loosened rails are shoved over on the ties away from the remaining spikes and launched endways against the short rail, shoved back under the spikes and the other short rail put in to complete the connection. The joints can then be bolted, the track spiked up and the flagman recalled.

Before breaking track to put in a facing point frog the main line guard rail should be correctly set up and spiked in place. This reduces work when track is torn up. If a spring rail frog is to be used, the spring rail can be spiked closed instead of setting the guard rail. This is not the best practice, however, for the spike may be forgotten and left, causing trouble with perhaps a derailment when the first train takes the curved route.

The length of the frog subtracted from the length of the track rail which it is to replace will give the length for the cut rail behind the frog. Measurements should be carefully taken with a reliable tape line, (the length can be checked by comparing with several standard length rails) and the amount of expansion allowed for joints should be governed by the expansion in the adjoining track. If the track is tight, the rails may "run" as soon as the track is opened up and cause difficulty if the short piece was figured to make an exact fit. The cut rail can be drilled before breaking the track, so that the frog and short piece can be put in and quickly bolted up in full. Bolting up the joints in full will prevent the rail from pulling out and leaving excessive expansion, in case the track is loose. The track ties behind the frog should be adzed off to permit the easy removal of the rail.

After the preliminary work is completed, flagmen should be sent out in both directions, choosing a time so that there will be a sufficient interval between trains to accomplish the work. The rail joints are then taken off of both ends and all the spikes pulled out of one side of the rail which is to be replaced by the frog and a short rail. The rail is then taken out, and the remainder of the spikes is removed from the switch ties where the frog is to lay. The frog and short rail are slid into place, and can be spiked to gage after the angle bars or other joint fastenings are bolted loosely in place. Before any spiking is done, the nuts on the joint bolts should be started sufficiently to prevent their being jarred off if the rail is struck with a spike maul. Before spiking joints the bolts should be well tightened to prevent bad gage or lips.

In placing the switch point, all the spikes are removed from that portion of the rail against which the switch rail is to be placed. The joint at the heel location is broken and shoved outward to form the stock rail. The rail bender or "jim crow" is placed the standard distance ahead of the switch point and the proper kink given the rail. The switch rail is heeled up against the end of the main line rail, and a rail for the turnout side is heeled in against the end of the stock rail. The angle bars, heel block and heel plate are then placed. In the meantime the slide plates are placed on the ties and are ready to be spiked. The track need be gaged only at the point and heel of the switch rail. Switch points should never be tight gage, and to avoid this it is advisable to have the gage a little bit wide, say ⅛ inch. After safely spiking the switch rail, frog and connecting piece, and having previously set up and spiked the guard rail, the track is safe for traffic and the flagmen may be called in.

The three operations of moving the rails transversely, putting in the frog, and putting in the switch were discussed separately, but they can be done successively in the order

named, or simultaneously, working on all of them at the same time.

Second Method. A method for putting in a frog of any number. The frog, connecting piece, main track lead rails and switch rail are set up in their proper order opposite the position they are to occupy. These parts are placed on the switch ties inside or outside the track. Half the outside spikes may be pulled out from the track rails to be removed, the flagmen are sent out, the remaining outside spikes are pulled and the first joint back of the frog point is broken. The track rails are shoved over to the end of the ties and used for the turnout track. The connected parts are then slid in to take the place of the old rails. All spikes must be pulled out where the switch rail and frog are to lie. If a joint in the track will interfere with the switch rail, a new stock rail and connecting rail can be set up and put in to replace the old rail just ahead of the switch, at the same time the frog is put in. Before spiking, the stock rail should be given a kink in the regular manner.

In case the rails on the opposite side of the track must be moved transversely, this operation should be performed and the guard rail set before the frog is put in. It saves respiking and time to put in the slide plates when spiking these rails, after they have been moved. A couple of spikes should, in this case, be driven down about half way on the inside of the rail, beside the tie plates, to keep the rail from climbing up over the risers and kinking in. Slide plates are usually placed directly in the center of tie. There are two disadvantages in this method: the tie will rock very easily, since all spikes are in a line on the center of the tie; little room is left on either side of the slide plate to set a spike, when it is desired to spike a switch closed, and the tie is likely to be split by a spike driven so close to the edge. Another method is to set one slide plate close up to one edge of the tie and the opposite slide plate close up to the opposite edge of the tie. In this method we get less rocking effect, and approach nearest to the method for spiking an ordinary track. If it is desired to spike a switch point closed, twice the width of tie is available at one side of the slide plate, and there is little liability of splitting the tie.

The switch rail, and leads which are to receive the turnout traffic can be put in place without breaking the main track, and no flag protection is necessary. For safety, switch rods should be put on as soon as the switch rails are both in.

Whenever removing rails from track ties on which the spikes are left on one side, the shoulder, if there is one, should be adzed off to facilitate the easy removal and replacement of rails.

To set a switch stand on main line the following method should be used. Spike the switch plates in place, leaving the track a little wide at the points, but not to exceed one eighth inch; connect up the stand, connecting rod, and No. 1 switch rod; place the switch stand parallel with the track and with the handle in a position corresponding to the position of the spiked switch point; spike the switch stand securely, taking up all lost motion for the closed switch point; remove the spike from the switch point, raise the handle of the swtich stand and throw the switch rails over (using a bar) against the opposite rail; then adjust the rod so that the switch handle will drop into the slot. Switch points should fit snugly against the rail when thrown over; a very tight fit is not desirable, as some part of the device will have to be sprung when throwing the switch. The switch stand with an adjustable movement for use with a rigid or non-adjustable switch rod, is rapidly gaining in favor of many railways. The rigid rod is made for the correct gage, and all adjusting is made in the stand or connecting rod.

The curved lead of a switch is usually spike lined by eye from heel of switch rail to toe of frog, although it is sometimes possible to obtain the correct distances (called ordinates) from rail head to rail head, at certain intermediate points on the lead. Before lining the turnout rail, the tangent or main line rail should be put in correct alignment; otherwise the lining up of the main track will destroy the line of the turnout track.

All ties should lie square across the track. This is especially true of head block ties in order to have the connecting rod perpendicular to the track; and the connecting rod should be perpendicular to the track in order that the switch may throw easily without binding. Stock rails should be standard length rails so that they may be replaced with minimum trouble. The gauge at the point of switch or point of frog should be a little loose, rather than tight.

Before leaving a switch in main line, it should be put in good surface and line; both guard rails should be set, bolted and blocked; all rails should be drilled, full bolted and full spiked; frog and switch points should have foot guard blocks; switch stand should be correctly set and locked; if the turnout side is ready to be used, all spikes should be removed which will hold switch points, movable frog points or the spring rail of a frog from movement; and all excess material should be loaded or neatly piled up.

The Kansas City Terminal Co. will expend about $35,000 to construct 1,100 linear feet of reinforced concrete retaining walls, the contract for which has been awarded to the William P. Carmichael Co.

The St. Louis & San Francisco R. R. will, it is reported, erect a passenger and freight depot at Lottie, La.

The Missouri, Kansas & Texas Ry. will enlarge and remodel the union station at McAlester, Okla.

The Virginian Railway is to spend approximately $2,000,000 in completing the new shops at Princeton, West Virginia, in providing increased yard trackage at various points along the line where needed and for equipment.

The Chicago & Alton has given the Toledo Bridge & Crane Company contracts for three 90-ft. turntables to replace 65-ft. turntables at Kansas City, Mo., Slater, Mo., and Venice, Ill.

The Chicago, Milwaukee & Puget Sound has filed plans with the City Commissioners of Spokane, Wash., for viaducts over Denver, Perry, Hogan, Madelia and Helena Sts., a part of the streets on the East Side over which the road must erect concrete and steel structures.

The Chicago, Rock Island & Pacific has filed plans with the Board of Public Works of Little Rock, Ark., for a proposed viaduct for pedestrians, to span the tracks and yards at the company's new freight depot in the east part of town. The viaduct is to be of steel and concrete, with wooden floor.

The Signal Department

GENERAL ADOPTION OF CERTAIN ESSENTIAL SIGNALING PRINCIPLES.*

By L. Kohlfürst.

Seventy years ago a conference was held at Birmingham, attended by representatives of all the railways then in existence in England, in order to come to an agreement on the subject of the colored lights to be used as night signals; the decision was based on the experiments and trials made by the brothers Chappe. The immediate result was that all the railways then in existence in England adopted a uniform system, which in course of time exercised a beneficial influence on the development of the railways in America and continental Europe, and assumed a certain international character.

It is self-evident that in this question of the unification of the fundamental signaling rules, we only consider in the first place the signals placed to protect certain parts of the track, that is the signals placed before junctions, at stations, on the open line, and called according to their object, home signals, route signals, starting signals, block signals, etc. Their function is to transmit at given points of the track, to the men in charge of the trains, the orders necessary at any time in order to authorize them to continue their jour-

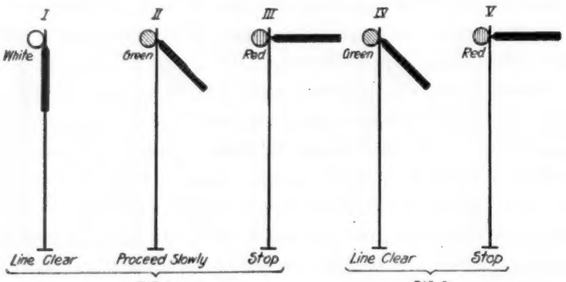


FIG. 1 FIG. 2.

ney, or in order to give them the order to stop; thus they perform exactly the same safety functions on all railways; it would therefore seem quite easy to settle common rules for these signals.

The English agreement of 1840, above referred to, already had especially considered the use of the semaphore, having an arm or blade, indicating the three elementary signals, I, II and III (fig. 1), by the position of the arm relatively to the pole. As regards night signals, white light was used for "line clear," green light for "proceed slowly," and red light for "stop"; and these very soon became adopted everywhere. On the other hand, the pole with movable arm, this signal par excellence, spread much more slowly; on many railways, both in Europe and in America, it found a competitor in the disk. This is all the more surprising, because as regards the railways in Central Europe, in Germany and especially in Prussia, semaphores were used from the time the railways started. Today, the superiority of the semaphore is no longer disputed anywhere, and there is a general tendency towards its gradual substitution for other signals which may still exist at dangerous points.

We may mention that if disks are less suitable for controlling the running of trains, it is because they are only able to give (at least properly) two separate indications, namely "stop" and "line clear." We therefore submit the following principle: "Semaphores alone should be used as visible fixed signals (main signals and advance signals, or home signals and distant signals)."

The unification of the colors of night signals, in which England took the initiative, became gradually extended, more or less generally, to all the railways of the world, and was shortly about to be realized to the satisfaction of everybody concerned, when owing to the increased speeds attained in England and the great extensions of stations which became necessary in consequence of the general growth of the traffic, a new theory, recommending the complete elimination of the white light, was advanced among signaling engineers. The chief reason for this proposition was the legitimate wish, becoming every day more and more pressing, of the drivers to have a "line clear" signal of a kind to enable them, and make it easier for them, to run fast trains up to time. Henceforth it became necessary that the signal should express the formal order of continuing to run at the regulation speed, and for this imperative form neither the semaphore arm depressed vertically in the day-time, nor the white light in the night, appeared sufficiently explicit and efficacious. Consulted on the question, the London corporation of engine drivers answered that all the driver on the locomotive wanted to know was whether he could go ahead full speed or whether he had to stop; that anything else could be left to the discretion of the driver or arranged in special cases by means of written or verbal instructions. In order to take this advice into account, it was decided to abolish the old signal "caution" or "proceed slowly," and only use the two indications IV and V (fig. 2).

These new signalling principles, which it is true are over forty years old, were very quickly adopted by several railways on the Continent who found themselves under similar conditions, as regards increase of speed and growth of traffic, as those previously mentioned. Nevertheless the English example was followed to a much smaller extent than in the first case of fixing the colored lights, although the disadvantages of white light were recognized and everybody was agreed as to the advantage of abolishing it.

It is quite probable that when white lights were abolished in England they would not at the same time have abolished the signal "proceed slowly" if a suitable color for giving that signal at night had been available. That gap has been filled since by yellow light, with which experiments giving very favorable results have been made in various countries, including foggy England and Denmark. The yellow light is free from the disadvantages of white light; on the contrary, as regards clearness and visibility, it has all the qualities that a signal light should have and thus makes it possible to add to the two-light system the third element which seems so much needed. The new fundamental indications to consider would then be those shown in figure 3. The English practice would be represented by VI, and VII would represent the central European practice, or to be more exact, the German practice; at the moment there still exists a regrettable difference which will hardly become settled soon; we may however remark that in some cases in America the arm is turned into the upper quadrant in order to indicate "line clear," as is the practice in Germany; this has been proposed as standard by the American Railway Association. It will therefore suffice and also—in order to save repetition—appear advisable to take as basis for our arguments only one of the two systems shown in figure 3.

In any case the three elementary indications can be expressed, in a perfectly general manner, by defining them, for instance as follows: (1) The arm placed at an angle of 45 degrees to the pole (at night, green light) indicates "running at normal speed is authorized;" (2) the arm placed at right angles to the pole (at night, red light) indicates

*From a Bulletin of the International Railway Congress.

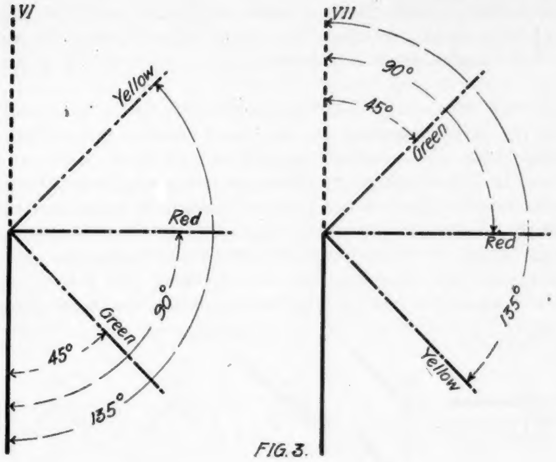


FIG. 3.

"danger, stop;" (3) the arm placed at an angle of 135 degrees to the pole (at night, yellow light) indicates "proceed at reduced speed."

Where the trains run on the right-hand track, the signal pole should be placed (whether simply a pole or on a gantry) to the right of the centre line of the track, and where the trains run on the left-hand track, to the left of the centre line of the track; the locomotive driver will naturally, in the former case, stand in the right half and in the latter in the left half of the cab. As regards the arms, which are at present generally placed on the side of the mast corresponding to the side run on, the most rational system, as regards economy of space and good visibility, is to place them on the side corresponding to the track affected, that is to say, to the left in the case of poles placed to the right, and to the right in the case of poles placed to the left.

If for the moment we leave this future and probable contingency out of consideration, there will, for instance, in the case of arrangement VII (fig. 3), be the three elementary indications VIII, IX and X, which will be available to give all the orders falling within the scope of the signals in question. Not only will they suffice perfectly under normal conditions, but it will also be possible, in exceptional cases, to have recourse to various extensions provided they are not in contradiction with the principles of the signalling system and with logic. A natural advantage of the system is that elementary indication VIII can never, in the case of coupled signals, appear simultaneously with indications IX or X, and that white lights are not used. If on any occasion a white light is seen on a semaphore, it will be due to a broken glass and have to be considered a stop signal.

When the signals of figure 4 are utilized on the line as block signals, they will only give two elementary indications, namely VIII: "line closed," and IX: "line clear," and will be designated accordingly; as regards home signals, route signals and starting signals, it will be necessary to have the three positions for the arms, namely VIII for "entrance prohibited," IX for "line clear for through line" and X "line clear for branch." If in addition we require that the route on to a second branch should be indicated on the home signal, we can always add a second arm.

As regards "proceed slowly" sections, whether they be so normally, or only provisionally, one can use either permanent or temporary semaphores giving the elementary signal X.

We desire to state in a general way some well-known signaling rules, viz: "All semaphores, intended to inform the train whether the section of track or line behind them can be run over or not, must normally be set to 'danger' and only set temporarily to 'line clear' for each train which is authorized to continue its journey. If these signals protect a section of line which includes switches, the levers operating the signals must be interlocked with those operating the switches, so that the signal can only be set to 'line clear' for a train if all the switches the latter has to run over are in the correct position, and so that none of these switches can be operated again until the signal in question has been brought back into its normal position, that of 'danger.' Similarly, in cases where two or more signals have to be utilized for trains which might meet and endanger each other within the block-section protected by these signals, these signals must be interlocked in such a way that it is never possible to set conflicting signals simultaneously to 'line clear.'"

As regards the condition specified in the first sentence in the above rule, which corresponds to what is known as the absolute block system, namely, that all signals must normally stand at "danger," it is also to be expected that there will be certain differences of opinion, for several railways which have automatic block signals will hardly be able to accept it.

The elementary indications shown in figure 4 would be specially important in their application to distant or advance signals, intended to repeat the indications of the visible signals heretofore considered, in order to avoid the risks which may result from a temporary reduction in the visibility of those signals or from their late recognition, for other reasons, by the drivers.

The advance signal, under the assumptions made above, informs the drivers, by means of elementary indications IX and X, what the position of the next main signal is; it therefore exceeds the functions at present attributed to it, if it directly orders the continuation of the journey or the reduction of speed, and thus gives orders which correspond to the position of the main signal. In such a shape it could no longer be included among signals giving information only, but becomes a true imperative signal, without however, it is evident, making the observation of the main signal less necessary that in its present information-giving state. This alteration of the character of the advance signals would result in a material reduction in the number of signal indications and signal meanings. If we add the two indications given by the advance signal: "the main signal is standing at danger" and "the main signal is standing at line clear," to the signals "danger" and "line clear," the total number would be increased to four, while with the system we are considering there would be only three indications.

Moreover, as regards this new form of the advance signal, there is no important reason for making it recognizable as such, when it is placed by itself next the track. On the other hand, it is evidently necessary that the main signal and the advance signal should be clearly distinguishable from each other, if the arms of the advance signals are placed on the poles of the main signals. Now experience has shown that this distinction can be made both easily and surely, and that without any modifications in the appearance of the arms or in the normal elementary indications, by specifying that the arm of the advance signal shall always

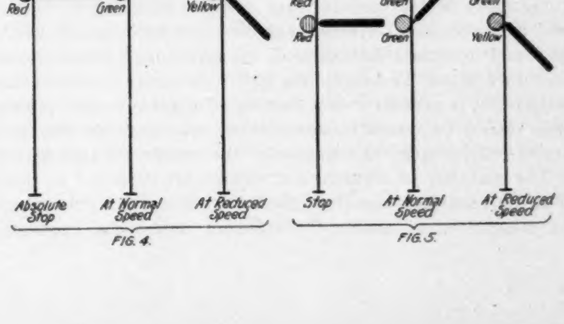


FIG. 4. FIG. 5.

be placed below that of the main signal on the same pole.

If the main signal and the advance signal are placed on one and the same pole, then the combinations of signals shown in figure 5 could occur.

In the normal position XI, we have the case already mentioned, when it is necessary, as an exception, that the advance signal should also command "stop." It is for this purpose essential that there should be a mechanical or electrical relation between the two arms, making it possible to set the advance signal to the "danger" position under all conditions, that is to say, independently of the position for the time being of the corresponding main signal, and to keep it in that position, as soon as the arm of the main signal placed on the same pole is set again to "danger."

The form shown in Fig. 5 is extensively used at present, both in England, and more especially on the newer American lines. The same applies to a certain extent to the signals at the entrance of stations and to the semaphores before junct:.ns; figure 6 shows the combinations for these signals.

It is this arrangement which the main European railroads use more especially for all the stations where the fast trains do not stop regularly but only occasionally and where in order to save loss of time the driver is informed by the advance signal whether the starting or exit signal is in the "line clear" position, that is to say, whether the run through is prepared and authorized. Combination XIV thus represents the normal stop position of the entrance signal, the upper being the main signal and the lower signal the advance signal of the exit signal of the station. Combinations XV to XVIII authorize the entrance to the through or to the branch line, and also show whether the road is clear or not.

Now summing up the principles which we may consider as suitable for general adoption as regards distant signals, we obtain the following rules:

"On all the lines run over by high-speed trains, it is necessary that every important visible signal (block signal, entrance signal, etc.) should be duplicated by an advance signal placed at least at the distance within which the brakes can stop the train, and interlocked with the main signal, so as to indicate 'free passage at normal speed' when the main signal stands at 'line clear,' and to order 'caution, proceed slowly' when the main signal stands at 'danger.'

"Whenever the pole of a main signal is also used for the arm of the advance signal, corresponding to the next main signal, this arm should be in the lower position. Moreover, the two arms must be coupled up in such a way that if the main signal stands at 'danger' this also automatically sets the advance signal placed on the same pole to 'danger.'"

Now as the advance signals, just like the main signals they are intended to duplicate, only affect the sense of sight, they are subject to the same limitations as regards their perception in good time. It therefore becomes more generally and urgently necessary to use auxiliary means in order to strengthen effectively the visible advance signals in order to ensure the proper running of the trains, at full speed, even in time of fog or when other conditions affect the visibility. For many years has it been tried, in many different ways, to find such means, without having up to the present obtained any definite results. The conviction has however become more or less general that it would suffice if one could find a signal, either visible or audible, or both, which would be found to attract the notice of the driver, and which should therefore be on the locomotive itself. In order to satisfy this purpose, it is necessary that this signal placed on the locomotive should be operated automatically as soon as the train arrives within a given distance of the visible advance signal.

The majority of signalling engineers are disposed to think that the repeating signal on the locomotive can by no means be considered as absolutely sufficient unless the apparatus in question automatically ensures the execution of the order given by the signal when the driver does not obey the stop order in good time when the train is approaching a main signal standing at "danger."

There are however many eminent engineers, particularly on the more important German or English steam railways, who think that any such apparatus placed on the locomotives are of a nature to blunt the attention, the watchfulness and the zeal of the drivers as regards the observation of the visible signals and consequently to form a disadvantage which counterbalances the advantages of the automatic apparatus for signaling and for applying the brakes of a train, as in the case of any failure of the apparatus placed

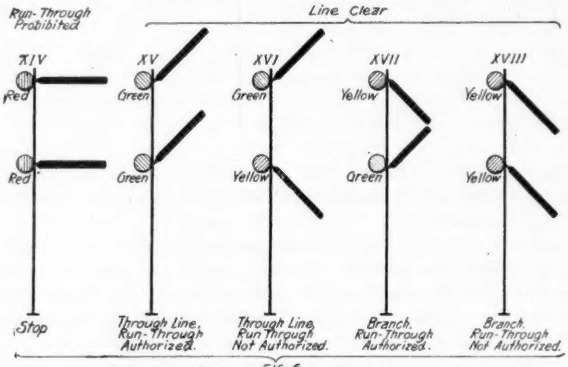


FIG. 6.

on the locomotive the danger it is intended to counteract is not only not prevented, but on the contrary seriously aggravated.

Other experts, especially locomotive engineers, consider, on the contrary, that the sudden stoppage of the train, without the personal intervention of the driver, must be considered dangerous and inadmissible. This objection is not without foundation, but it has long been refuted by a precedent; we refer to the alarm signal placed at the disposition of passengers.

All these objections, and any others which may be raised against automatic cab-signals or against the automatic application of the brakes, disappear however or at least lose much of their value when we consider, on the one hand, the urgent needs created by the continual increase of speeds and, on the other hand, the notorious insufficiency of the help which other alarm signals, detonators, flares, etc., give to the visible fixed signals of the line. If we consider moreover the satisfactory results by now obtained on several important French steam railways, and on a much greater scale on very important electric railways in England and more especially in America, with more or less old devices of this kind, is appears justifiable to enunciate the following rule for lines on which trains run having speeds exceeding 50 miles per hour or following each other at intervals of about three minutes or less (these figures not representing absolute limits fixed once for all, but very variable in accordance with the other service conditions):

"On the railways where there are high speeds or where trains follow each other at exceptionally short intervals, it is necessary that the visible track signals, which indicate how the train is to run, should be duplicated by apparatus placed on the locomotive, which in case of the conscious or uncons-ous over-running of a signal standing at danger, should operate the brake of the train and automatically induce the stopping of the train. If the same apparatus, moreover, announces the approach to each signal, by a visible signal shown in the cab, it can be considered as suited materially to help the organization of a service of fast trains and to increase the safety at the same time."

The considerations we have brought forward in this note

show that the fundamental rules enunciated above can serve as bases for a general agreement. They have moreover been adopted in practice or at least tried on a large proportion of the railway systems of the world.

It cannot be disputed that the rearrangement of the signaling system, on the basis of the six rules enunciated above, will involve a considerable expense in the case of many railways, in particular of those which at present only have a limited number of semaphores or of central apparatus; this expense will however be fully justified by the increased safety, and will be counterbalanced by the economic advantages which will result.

As regards the difficulties which will be increased in connection with the train service during the transition period, while the old signaling system is being replaced by the new, they will be comparatively slight on the railways which have already abolished white light as a signal-light color, as it will only be necessary to adopt the new signal "caution, proceed slowly," or to add the yellow light to the red and green lights. On the other hand, the railways which still use white light to indicate "line clear" will have to replace the latter, which at present means "proceed slowly," by a yellow light. This is, it is true, a considerable alteration, tempered however by the fact that any errors possible during the first days of the transition period will not have any serious consequences; they cannot produce any danger, but only loss of time, by the erroneous interpretation of the new green light in its old sense.

The Maintenance of Way Department

SCREW SPIKES.

Editor Engineering:

I recommend the use of screw spikes only on first-class track where treated ties are used, same being protected by tie plates. I do not consider that it is an advantage to use screw spikes in treated ties unless the same are laid in stone ballast with not less than 12 inches of stone beneath the tie.

(Signed) E. Stimson,
Chief Engineer Maintenance of Way, B. & O.

Editor Engineering:

There are certain places and conditions under which the use of a screw spike is to be advocated as against the ordinary spike.

In regard to using them on dirt ballast and other track which is liable to heave, I am of the opinion that each individual case must be settled on its own merits. The probabilities are that the traffic over the dirt ballasted track would be such that the ordinary spike would answer all purposes.

As to the use of wooden tie plugs to receive spikes, I advocate the use of a wooden tie plug to plug the hole after the ordinary or screw spike has been withdrawn. As to the insertion of a wooden plug before putting in the screw spike, that's another question and its answer would depend upon conditions.

(Signed) George W. Kittredge,
Chief Engineer, N. Y. C. & H. R. R. R.

Editor Engineering:

We have not entered into the use of screw spikes on our road because we did not feel that they met the conditions with which we have had to contend—our track laying in a region subject to extreme variations in temperature and the necessity for shims existing, it seemed that the ordinary spike would best serve our purpose. We also use yellow pine tie and find no difficulty in using ordinary spikes. We use wooden tie plugs when ties have been used in track for a rail base less in width than one to which we are changing, and we find this practice very satisfactory.

(Signed) Geo. H. Burgess,
Chief Engineer, Delaware & Hudson.

Editor Engineering:

While we have not yet commenced the use of screw spikes, in our opinion the use of this method of holding the rail to the tie is growing in favor and use every day.

We believe that the tendency to combine the rail fastener, tie plate and rail anchor in one combination tie plate screwed and bolted to the tie is gaining in favor, and will likely be the general practice before very long.

(Signed) M. S. Blaiklock,
Engineer Maintenance of Way, Grand Trunk.

Editor Engineering:

We have in use a few screw spikes on bridges, but we are not making any regular practice of the use of screw spikes, nor are we inclined to advocate their use. The first cost of screw spikes is very considerably more than the ordinary cut spikes and cost of installation is considerably greater. Under the present existing physical and financial conditions of the Frisco Lines, we do not feel warranted in using screw spikes, and it is somewhat questionable in my mind whether it would pay to use screw spikes even on a road which is in the best physical and financial conditions. There would, of course, be much less expense necessary on account of shimming on a road, which is fully ballasted, than there would on a line not fully ballasted or with dirt ballast, and this would be one point in favor of ordinary cut spikes on dirt ballasted track or lines which are not fully ballasted.

(Signed) M. C. Byers,
Chief Engineer Operation, St. Louis & San Francisco.

Editor Engineering:

We are not using screw spikes at present.

When the ordinary nail spikes are drawn we use wooden tie plugs in order to keep the moisture from the timber.

I assume that the screw spike will come into use in the future, but our company has not had practical experience with it up to the present.

(Signed) D. W. Lum,
Chief Engineer M. W., Southern Ry.

The Cincinnati, New Orleans & Texas Pacific Ry. will install an 80-ft. electric turntable, designed to turn locomotives of 180 tons weight. A contract for the turntable is said to have been awarded.

The Pennsylvania R. R. has made a contract with the city council of Rahway, N. J., whereby the railroad is to spend $1,500,000 in elevating its tracks through the city, and to pay for all new streets cut through. Work must be started within three months after the contracts are filed, and must be completed within two and one-half years.

Glossary of Track Terms

K. L. Van Auken.

(Continued from page 435)

Low switch stand, n.—A stand with a low target, and a lever which rests on the ties when the switch is closed. For use in yards.

Machine, n.—A track laying machine.

Main line, n.—The principal track in any district over which trains are operated.

Make up, v. t.—To "make up a train." To place cars intended for certain trains in their proper order on a track.

Mock joint, n.—An insulated joint on which a short piece of rail is used on the outside to stiffen up the joint and take part of the wheel load off the main line rails.

Monkey, n.—The hammer of a pile driver.

Mormon, n.—A scraper made of wooden planks with a steel tip. For pulling dirt down a bank or finishing top of grade.

Movable point frog, n.—A device for providing a continuous rail alternately for either of two intersecting routes.

Muckers, n.—Laborers engaged in excavating.

Mud, v. t.—A word used by a man in a lining gang to call for a new hold.

Mud sill, n.—A heavy timber imbedded in the earth at the end of an embankment, to form a support for stringers.

Mud track, n.—Same as "dirt track." Track surfaced with dirt.

Neck, n.—"Neck of a frog." Same as "throat of a frog."

Nip, v. t.—To raise with a bar.

Nipper, n.—A man detailed to nip up ties for a gang of spikers.

Nipping block, n.—A piece of wood used as a fulcrum in nipping up ties for a spiking gang.

No. 2, n.—A dirt shovel.

Offset angle bar, n.—Same as "compromise angle bar" or "step angle bar." An angle bar designed to connect smoothly two rails of different size.

Old man, n.—(1) A device for holding a ratchet rail drill in position. (2) A ratchet drill. (3) A man in charge of a number of gangs of laborers, or a man at the head of a department.

Open track, n.—A body track reserved for movements through a yard.

P. F.—Point of frog.

P. S.—Point of switch.

Panel, n.—A rail length of track.

Paper collars, n.—Officials.

Passenger yard, n.—A railway yard in which passenger equipment is kept.

Passing siding, n.—A special siding, usually connected with the main track at both ends, and used to enable trains to pass each other.

Passing track, n.—Same as "pasing siding."

Pecky tie, n.—A tie made from a cypress tree affected with a fungous disease, known locally as peck.

Peddle, v. t.—To distribute track material.

Peddler, n.—A man who distributes track material.

Penstock, n.—An arrangement for supplying locomotive tanks with water. It consists of a pipe with a pivoted spout which may be swung out over the engine tank. The water is supplied under pressure and is controlled by a valve.

Pick, v. t.—"To pick up track." To surface track.

Pick, v. t.—"To pick up low joints." To raise low joints.

Pickled tie, n.—Same as treated tie. A tie which has been subjected to a process for preserving it from decay.

Pickeroon, n.—A small sharp pick used in rolling ties into the trams of a track-laying machine.

Pile plank, n.—A plank driven in the ground in the same manner as a pile.

Pinch, v. t.—"Pinch a car." To move a car by the use of a pinch bar.

Pioneer car, n.—The head car in a track laying train; on which the engine for operating the track machine is carried.

Piped, adj.—"Piped rail." A rail which splits in use. More especially a rail which split at some point other than the end.

Pipe run, n.—An assemblage of pipe lines of an interlocking plant, with their carriers and foundations, in a common course.

Pipe wrench, n.—A track wrench over the handle of which a piece of iron pipe is driven, in order to lengthen the handle.

Pit, n.—See (1) Borrow pit. (2) Cinder pit.

Pit track, n.—(1) The loading track in a gravel or sand pit. (2) Track on which cars are placed for loading cinders from a cinder pit at a roundhouse.

Plan, n.—A drawing furnished for the guidance of work.

Plate n.—
See (1) Continuous plate.
(2) Gage plate.
(3) Heel plate.
(4) Slide plate.
(5) Tie plate.

Plate frog, n.—A frog in which the different parts are riveted to a heavy base plate.

Plow, n.—
See (1) ballast plow.
(2) bull dozer.
(3) center plow.
(4) frost plow.
(5) side plow.
(6) spreader.

Point, n.—(1) "Theoretical point of frog." The imaginary point where the gage lines of a frog intersect. (2) "Actual frog point." The end of the metal at the converging gage lines.

Pole man, n.—The man who handles the rail derrick on the head end of the track machine.

Pole tie, n.—A tie made from a tree of such size that not more than one tie can be made from a section. Such a tie generally shows sapwood on two sides.

Pollicing.—"Pollicing the right of way." General clearing up of right of way.

Pollock, n.—A Polander.

Poling yard, n.—A yard in which the movement of cars is produced by the use of a pole or stake operated by an engine on an adjoining parallel track. The movement may be facilitated by an assisting grade.

Post, n.—"Whistling post." A post with a standard sign on it, showing that there is a grade crossing or other dangerous place ahead, for which the engineer should sound the whistle as a warning.

Plug, n.—A short railway branch line.

Profile, n.—The intersection of a longitudinal vertical plane with the ground or established gradients; or a drawing representing same.

Pumping track, n.—Track where the track ties begin to work up and down excessively in wet ballast.

Pumpkin vine, n.—A railroad containing many sharp curves.

Push car, n.—Same as a "dumpy" or "dump car."

Puzzle switch, n.—A double slip switch.

Quartered tie, n.—A tie made from a tree of such size that four ties only are made from a section.

Rail, n.—Rail, used as a collective noun for plural.

Rail, n.—
See (1) ball worn rail.
(2) battered rail.
(3) broomed rail.
(4) lift rail.
(5) line bent rail.
(6) live rail.
(7) piped rail
(8) ravelled rail.
(9) receiving rail.
(10) running rail.
(13) surface bent rail.
(11) skid rails.
(12) stock rail.
(14) taper rail.
(15) third rail.
(16) wing rail.

Rail bender, n.—A tool for giving a rail a uniform curve from end to end.

Rail brace, n.—A device to be spiked against the outside of a rail to prevent track from spreading or to hold guard rails in position.

Rail cut, adj.—"Rail cut tie." A tie which a rail has cut down and sunk into.

Rail fork, n.—A fork shaped tool used in turning and handling loose nails.

Rail nipper, n.—In a track laying gang a man who raises the rail which is already in position, in order to facilitate heeling in the next rail.

Rail plug, n.—Same as "expansion plug."

Rail rests, n.—Supports for holding one or more rails a sufficient height above ground to prevent their being covered with snow.
Rail square, n.—A wooden square used to determine whether joints in a track are directly opposite.
Rail-wear, n.—The deterioration of a rail caused by passing trains.
Railroad, v. t.—
(1) To move a stationary engine by an anchor line and drum or wench.
(2) To accomplish a large amount of work.
(3) "Railroad" an exclamation or warning to denote the approach of a train, or to warn of any danger.
Ram, n.—The hammer of a pile-driver.
Ravelled rail, n.—A defective rail which has been worn by the passage of wheels so that small ragged strips protrude outward from the ball.
Receiving rail, n.—The rail at a joint on a one-way track on which the wheels drop in the direction of traffic.
Receiving tracks, n.—Tracks which are used for incoming trains.
Receiving yard, n.—A yard for receiving incoming trains.
Re-gage, v. t.—To draw the spikes on a track, and respike it to standard gage.
Relaying, adj.—"Relaying gang."—A gang which is relaying track.
Relaying, adv.—Replacing worn track rails with new rails.
Relief track, n.—An extended passing siding, long enough to allow an inferior train to continue running while a superior train passes.
Rerail, v. t.—To put a car back onto the track, after it has been derailed.
Reverse curve, n.—Two curves in opposite directions in a continuous line joining at a common tangent point.
Right-of-way map, n.—A plat representing the actual location and dimensions of the property, rights or franchises that are owned or controlled by a railroad company.
Rigid frog, n.—A frog in which all parts are stationary.
Rigid switch stand, n.—A switch stand which allows for no emergency spring movement if the switch is run through.
Rip rap, v. t.—To cover a bank or embankment with rip rap.
Rip rap, n.—Stone placed on a bank or an embankment to protect same from stream washing.
Road, n.—"Hitting the road, hitting the gravel, hitting the dirt or hitting the grit." A hobo term, meaning to travel.
Roadbed, n.—The finished surface of the roadway upon which the track and ballast rest.
Roadway, n.—That part of the right-of-way of a railroad prepared to receive the track.
Road grader, n.—A machine for leveling the top of a grade.
Roberts-man, n.—A hobo who has worked on a Roberts track laying machine.
Rod, n.—
See (1) adjustable switch rod.
(2) bridle rod.
(3) head rod.
(4) number one rod.
(5) switch rod.
Rolling stock, n.—The cars and engines owned by a railroad.
Rough neck, n.—A brakeman or switchman.
Run, v. t.—To "run through a switch." To pass over the switch points (trailing) when they are not lined up for the route.
Run around track, n.—A short track connected at either end with a main track; the former track is kept clear so that a train may be spotted on the main track and the engine can run around it and couple on the other end.
Run-off, n.—A temporary incline in a track from the old level to a higher level part which has just been raised.
Running rail, n.—A rail which receives the bearing of wheels.
Running surface, n.—Putting a track in a condition just good enough to prevent injuring of rails by an engine running over it slowly.
Running track, n.—A track reserved for movements through a cluster or general yard.
Rust eaters, n.—The rail gang. The men who handle rails in track construction.
Runway, n.—A plank or board passage way for wheel barrows.
Safety switch stand, n.—Same as "automatic switch stand."
Sag, n.—A dip or low section in a track.
Sand, n.—Any hard, granular, comminuted rock material, finer than gravel, and coarser than dust.
Sand hog, n.—A man who opens and dumps automatic ballast cars.
Sand siding, n.—A gauntlet track covered with sand, used in place of a derail. The sand exerts great resistance and soon stops a train.
Sap tie, n.—A tie which shows more than a prescribed amount of sap-wood in cross-section.
Sawed tie, n.—A tie having both faces and sides sawed.
Scale track, n.—A track leading to a scale for weighing cars.
Scissor bill, n.—(1) The name given by the hoboes to a local laborer working on an extra gang. (2) An officious person.
Scoot, n.—A short local passenger train.
Score mark, n.—A mark made by the ax as an aid in hewing out a cross tie.
Scraper, n.—"Fresno scraper." A large slip for two or more teams.
Semaphore signal, n.—A device consisting of a movable arm attached to a mast, the indications being given by the position of the arm.
Separating yard, n.—A yard adjoining a receiving yard, in which cars are separated according to district, commodity, or other required order.
Set, v. t.—"Set a spike," to place a spike vertically on a tie and tap lightly with the hammer, so that the spike will be in the proper position for driving.
Shakes, n.—Separations of the wood fiber of a tie, due to the action of the wind.
Shank, n.—(1) The body of a bolt; (2) The body of a spike.
Sharp curve, n.—Same "heavy curve."
Sharp flange, n.—A wheel flange which has been worn thin, and is liable to cause a derailment.
Sheet, v. t.—To place and brace boards against an earthen bank to prevent caving in.
Sheet piling, n.—Planks driven to form a solid wall to support a bank while excavating.
Sheeting, n.—Same as "lagging."
Shim, n.—"Expansion shim."—A flat piece of iron inserted between the ends of rails in track laying, to make allowance for the expansion of the rails.
Shim, n.—"Track shims."—Wooden blocks of varying thickness, for insertion between a rail and the ties; used to raise a low place in a track in the winter time, when the ties are frozen in the ground.
Shim, v. t.—(1)To place surface shims under a track; (2) To place expansion shims between the ends of the rails when laying track.
Shim spike, n.—Same as "frost spike."
Shoe, n.—A device used to prevent sliding friction between the wheels of a car and the rails; used when ballast unloaded in center of track is being spread by means of track ties placed in front of and against the wheels of a car, and the car shoved ahead.
Shoo fly, v. t.—To build around an incompleted fill, cut, bridge, or tunnel.
Shoo fly, n.—A track built around an incompleted fill, cut, bridge, or tunnel.
Short punch angle bar, n.—An angle bar with the minimum standard distance between holes, where several different standards are used.
Shoulder, n.—The top part of the railroad embankment, from the end of the ties to the edge of the slope.
Shoulder, v. t.—To "shoulder up track."—(1) To build and shape up the embankment outside the end of the track ties; (2) To build a shoulder.
Shunt, v. t.—To switch cars.
Shuttle-engine, n.—(1) An engine used in a hump yard to carry the brakeman to the top of the hump; (2) An engine which is run back and forth to try out the routes in a new interlocking installment.
Side plow, n.—A ballast plow which shoves the ballast all off on one side of the train.
Siding or side-track, n.—A long track away from a yard connected with the main or running track at one or both ends and used for the storage or irregular movement of cars or trains.
Siding, n.—
See (1) Catch siding;
(2) Passing siding.
(3) Sand siding.
Side track, v. t.—To run a train in on a side track.
Sign, n.—A visible signal.
Sign, n.—
See (1) bridge sign.
(2) crossing sign.
(3) curve sign.
(4) flanger sign.
(5) junction sign.
Signal, n.—
See (1) advance block signal.
(2) block signal.
(3) distant block signal.
(4) fixed signal.
(5) home block signal.
(6) semaphore signal.
(7) tell tale.
(8) whip guard signal.
Simple curve, n.—A change in direction by means of a single radius.
Single slip switch, n.—A slip switch with only one curved track connection, thus affording only one route between the crossing tracks.

Skeleton track, n.—A track which has no filling between the ties.
Skid, v. t.—To move material over skids.
Skids, n.—Beams along which material is slid in unloading, loading or piling up material.
Skid rails, n.—Rails designed especially for use as skids, provided with hooks which fit the stake pockets of a flat car.
Skinner, n.—A teamster in a grading gang.
Slab tie, n.—A tie made from slabs.
Slabbed tie, n.—A tie sawed on top and bottom only.
Slag, n.—The waste product, in a more or less vitrified form, of furnaces for the reduction of ore; usually the product of a blast furnace. Used for ballast.
Slew, v. i.—To slide sideways out of position.
Slewed track, n.—Track which has slid out of line.
Slide plate, n.—A metal plate under a switch point, a movable frog point, or the spring rail of a frog, over which those devices slide n their lateral movement.
Slip, n.—A dirt scraper used in grading.
Slip switch, n.—A crossing of two railway tracks, and combined with it a curved track or tracks and switch points providing a route from one crossing track to the other.
Slope, n.—The inclined face of a cut or embankment.
Slope stake, n.—A stake set to mark the top or bottom of a slope.
Sloper, n.—A laborer who finishes off the slope of an embankment or cut.
Smoke, n.—Core sand from an iron foundry which is discarded after being used as long as possible and which is exceedingly fine and dry.
Smooth, v. t.—To "'smooth up track." To raise the low places, put-
Snipe, n.—A section hand.
Snipe up, v. t.—To surface a track, raising only the worst parts.
Snow fence, n.—A fence constructed to prevent snow drifting onto the right-of-way.
Soldier, v. t.—To kill time or to shirk.
Soldier, n.—One who shirks.
Solid center frog, n.—A frog in which point and wing rails are cast in one piece, and require neither frog bolts nor frog clamps.
Spacing, n.—The distance between centers of ties on a track.
Spear spike, v. t.—To omit part of the spikes on the inside of a track.
Special frog, n.—A frog made to fit into a special track layout, where no regular frog will fit.
Special tracks, n.—In a typical yard there will be several tracks devoted to special purposes, varying with the local conditions. These will include caboose tracks, scale tracks, coaling tracks, ash-pit tracks, bad-order tracks, repair tracks, icing tracks, feed tracks, stock tracks, transfer tracks, sand tracks, depressed tracks, etc.
Speeder, n.—Same as "armstrong."
Spike, n., s. or p.—Used as a collective noun to denote plural.
Spike-killing.—The destruction of a tie on account of frequent driving and pulling of spikes.
Spike puller, n.—(1) A short claw-like tool designed to clutch a spike which is between a rail and a guard rail, and which cannot be reached by an ordihary claw bar. (2) A man who pulls spike.
Spike-punch, n.—A blunt pointed instrument for driving down spike stubs so that they will be flush with or below the tie face.
Spike-slot, n.—A notch in an angle bar into which the spike is to be driven.
Spike throat, n.—The body of a spike just beneath the head, which rests against the rail base.
Spike-stub, n.—A spike with the head broken off.
Splices, n.—Angle bars or fish plates.
Split tie, n.—A tie made by splitting from a tree of such size that two or more ties can be made from a section.
Spiral curve, n.—Same as "easèment curve." A curve in which the degree of curvature is comparatively low at the point and increases until the maximum degree is reached.
Spoon, n.—A shovel.
Spot, v. t.—To place cars. To move cars to a desired position.
Spot, n.—The black line on the spot board.
Spot, n.—Cars "on spot." Cars in the correct or desired position.
Spot-board, n.—A broad straight-edged board painted white, with a wide black line running across it transversely. Used in raising track to a definite height or grade.
Spot board blocks, n.—Blocks (used in raising track with the spot board) whose height is the same as the distance from the bottom of the spot board to the black line or "spot" on the board.
Spreader, n.—(1) Same as "bull dozer." (2) A center plow fastened to the under side of a car. Used for leveling off ballast which has been dumped in the middle of the track.
Spring rail frog, n.—A frog with a movable wing which rests against the frog point and takes part of the wheel load when a train passes on the main track. When taking the side track the movable wing is sprung out by the wheel flanges.
Spur, v. t.—To "spur out a car." To place a car on a short piece of track, all connection with other tracks to be broken after the car is in the desired position.
Spur track, n.—A stub track, usually leading to and serving an industry, or warehouse, freight house, etc.
Square joints, n.—Track joints which are directly opposite each other in the track.
Stake, n.—A specified amount of money which a hobo plans to save up before quitting the job.
Stake, n.—
See (1) ballast stake.
(2) center stake.
(3) finishing stake.
(4) grade stake.
(5) slope stake.
Station board, n.—A sign board about a mile from a station announcing the distance to the station.
Station-grounds, n.—Property to be used for station purposes.
Steel, n.—Track rails.
Steel-car, n.—(a) A small truck used to carry the rails when laying track. (b) The car containing the rails, in a track laying machine.
Steel roller, n.—The man who rolls the rails into the trams on a track laying machine.
Stem, n.—The "main stem." The main line.
Step angle bar, n.—Same as "offset angle bar" or "compromise angle bar."
Step fish plate, n.—A fish plate designed to make a smooth joint of two rails of different size.
Step joint, n.—A joint between two rails of different size.
Stock-rail, n.—(1) The bent rail in a switch, against which the straight track switch rail rests when closed. (2) Either rail in a switch against which a switch rail may be thrown.
Stone train, n.—A train carrying stone for ballast or construction.
Storage yard, n.—A yard in which cars are held awaiting disposition.
Stormy-end, n.—The end of the rail which comes out of the track-laying machine first.
Strapper, n.—The man who hangs the angle bars on the head rails in laying track.
Straps, n.—Angle bars or fish plates.
Strap, n.—"Safety strap."—A light strip of iron spiked to head block ties. The strap is beneath the connecting rod and prevents the latter from dropping down and being disconnected in case the nut works off the crank on the switch stand.
Straw, n.—(1) An assistant foreman. (2) An overseer subordinate to the assistant foreman.
Straw, v. i.—To work as an assistant foreman.
Straw-boss, n.—Same as "straw."
Straw man, n.—A fraudulent name carried on the pay roll, for which there is no laborer in the crew.
Streak-of-rust, n.—A railway line.
Stretch, v. t.—"To stretch steel."—(1) To provide for expansion in a tight track, by bucking the rails ahead towards a point where there is more expansion. (2) To set up rails.
Strict heart tie, n.—A tie having no sapwood.
Stringers, n.—The timbers laying longitudinally under, and supporting the track on a bridge.
Stripping, n.—Soil removed from the top of a gravel pit or quarry.
Stripping, n.—"Stripping out track." Removing the ballast from between the ties.
Stub switch, n.—A switch in which the stub ends of rails are moved transversely to shift the route of trains.
Stub track, n.—A short track connected with another at one end only.
Stuff, n.—Money.
Subgrade, n.—The tops of embankments and bottoms of cuts, ready to receive ballast.
Summit or hump yard, n.—A yard in which the movement of cars is produced by pushing them over a summit, beyond which they run by gravity. The movement from the base of the summit may be facilitated by an assisting grade.
Sun-kink, n.—A sharp crook in the track; caused by the heat of the sun expanding the rails until sufficient force is generated to throw the rails out of line.
Supported joint, n.—A rail joint which has a tie directly beneath the point of junction of the rails.
Surface, n.—The condition of the track as to vertical evenness or smoothness over short distances.
Surface, v. t.—To raise track to proper grade, or to a more or less smooth condition.
Surface, n.—"Skeleton surface."—A temporary surface where no filling has been thrown between the ties.
Surface-bent, adj.—"Surface-bent-rail."—A rail which has been

bent horizontally, and has taken a permanent set.

Suspended joint, n.—A rail joint having no tie directly below the junction of the rails.

Swing, n.—A piece of track designed to be tangent, which has moved to one side for a considerable distance. A "kink" is a short "swing."

Swing-train, n.—A train which conveys track material from the material yard to the front.

Switch, n.—A switch is a device for shifting the route at the entrance of a turnout. (Camp.)

Switch, n.—
See (1) channel switch.
(2) double slip switch.
(3) intermediate switch.
(4) single slip switch.
(5) slip switch.
(6) stub switch.
(7) three throw switch.
(8) three way switch.

Switch, v. t.—To distribute cars in a desired order, by using switching tracks.

Switch-point, n.—"Reinforced switch point."—A switch point to the side of which is bolted a flat iron bar stiffener.

Switch rod, n.—A transverse bar or rod connecting the two point rails of a switch.

Switch stand, n.—
See (1) automatic switch stand.
(2) ground switch stand.
(3) high switch stand.
(4) intermediate switch stand.
(5) jack knife switch stand.
(6) low switch stand.

Switching district, n.—That portion of a railway at a large ter-
(8) safety switch stand.
(9) three throw stand.
ting a track in good surface
minal into which cars are moved and from which they are distributed to the various sidetracks and spurs to freight houses and manufacturing establishments served from this district, by yard or switching engines.

Tallow-pot, n.—A locomotive fireman.

Tamp, v. i.—(1) To pack down with light blows in grading. (2) To compact earth or ballast under track ties.

Tamp.—(1) "Shovel tamping"—Tamping track with shovels only. (2) "Bar tamping."—Tamping with tamping bars. (3) "Pick tamping."—Tamping stone ballast with tamping picks.

Tangent, n.—Straight track.

Taper rail, n.—A rail tapered down from a heavy to a lighter section, to be used in place of a compromise joint between two rails of different size.

Tapped tie, n.—A tie made from a tree, the resin or turpentine of which has been extracted before felling.

Target, n.—The day signal used on a switch stand.

Team-track, n.—A track from which cars are loaded or unloaded into wagons.

Tell-tale, n.—A whip guard signal.

Terminal, n.—The facilities provided by a railway at a terminus or at intermediate points on its line for the purpose of handling its business.

Terminal, n.—Freight terminal. The arrangement of terminal facilities for the handling of freight business.

Terminal, n.—Passenger terminal. The arrangement of terminal facilities for the handling of passenger business.

Terminal, n.—Rail and water terminal. A terminal where freight is interchanged between railway cars and vessels.

Terrier, n.—An experienced itinerant track laborer.

Third rail, n.—A rail placed between two rails at standard gage, to provide for narrow gage operation by using in connection with one of the standard gage rails.

Three level crossing, n.—A crossing in which the roads are at three different heights or elevations.

Three rail track, n.—A track with three rails, to accommodate both standard and narrow gage equipment.

Three throw stand.—A switch stand for a three way switch.

Three way switch, n.—A switch placed where two side tracks diverge from a main track at a common point.

Three tie joint, n.—A joint in which the angle bars rest on three ties, the central tie being directly beneath the meeting of the rails.

Throat, n.—The open portion of the frog where the rails are closest together. (Camp.)

Throat-cut, n.—"Throat cut spike"—A spike into which a notch has been worn where it is in contact with the rail base.

Throw, n.—The distance the switch points move laterally when the switch is lined from one route to the other.

Tickler, n.—A warning signal for a bridge, consisting of a number of evenly spaced cords suspended over a track, the lower ends of the cords being at such a height that a man standing on top of a car will be struck by the cords.

Tickler pole, n.—A pole which supports a tickler signal on a projecting horizontal cross arm.

Tie, n.—
See (1) cross tie.
(2) cull tie.
(3) doty tie.
(4) heart tie.
(5) hewed tie.
(6) half round tie.
(7) pecky tie.
(8) pole tie.
(9) quartered tie.
(10) sap tie.
(11) sawed tie.
(12) slab tie.
(13) slabbed tie.
(14) split tie.
(15) strict heart tie.
(16) tapped tie.
(17) wane tie.
(18) pickled tie.
(19) treated tie.
(20) rail cut tie.

Tie buckers, n.—Men who carry ties ahead of the track machine, for the track which is being constructed.

Tie face, n.—(1) The upper or lower plane surface of a tie (technical). (2) The upper surface of a tie.

Tie-line, n.—A rope used to show the proper lateral position for ties which are being distributed for a track.

Tie-liner, n.—A laborer who places ties in proper line.

Tie plate, n.—A plate placed between the tie and the rail to increase the bearing surface, and to prevent rail cutting into tie.

Tie plate gage, n.—A device which is placed on top and with one end coincident with the end of the tie, and which in this position shows the proper location for tie plates.

Tie-plater, n.—The laborer who places tie plates on the ties.

Tie plug, n.—A short piece of wood used to fill a hole left in a tie where a spike has been pulled.

Tie-pole, n.—A pole which has marks on it to show the proper distances center to center for track ties, and which is used in spacing ties.

Tie-spacer, n.—A laborer who places ties at their proper distance center to center ready for laying rails.

Tie-trammer, n.—A laborer who rolls the ties from the tie car into the trams on a track machine.

Tight gage, n.—Track in which the rails are closer than the standard track gage of the road.

Tight track, n.—Track with too small an allowance for expansion.

Time, n.—"To give a man his time."—To discharge a man.

Toe, n.—"Toe of frog."—The end of the frog nearest the switch point.

Toe, n.—"Toe of slope."—The intersection of a slope with the ground surface in embankments, and the plane of roadbed in cuts.

Toe-casting, n.—A casting used between the toe rails of a spring rail frog.

Toe-in, v. t.—To "toe-in" a frog against another rail; to place the toe of the frog against the end of a rail in the track.

Top-of-slope, n.—The intersection of a slope with the ground surface in cuts, and the plane of the roadbed on embankments.

Track, n.—Ties, rails and fastenings with all parts in their proper relative places.

Track, n.—
See (1) body track.
(2) cinder track.
(3) corduroy track.
(4) crossover track.
(5) dead track.
(6) dirt track.
(7) distribution track.
(8) drill track.
(9) gauntlet track.
(10) house track.
(11) industry track.
(12) ladder track.
(13) lead track.
(14) loading track.
(15) mud track.
(16) open track.
(17) passing track.
(18) pit track.
(19) receiving track.
(20) relief track.

(21) running track.
(22) run-around-track.
(23) scale track.
(24) siding or side track.
(25) skeleton track.
(26) slewed track.
(27) special track.
(28) spur track.
(29) stub track.
(30) team track.
(31) three rail track.
(32) tight track.
(33) transfer track.
(34) unloading track.
(35) wye track.

Track-bolt, n.—A bolt used in a track joint.

Track-circuit, n.—An electric circuit carried through the rails of a track.

Track-chisel, n.—A chisel used for cutting rails.

Track gage, n.—A tool for measuring the perpendicular distance between rails, and for making this distance uniform.

Track map, n.—A map used primarily for showing existing physical conditions, including tracks, bridges, buildings, water service and mains, leases, station facilities and all of the physical and operating features.

Track-walker, n.—A laborer who walks over the track to discover and repair or report breakages.

Traffic, n.—"Against traffic."—In a direction opposite to the direction trains run.

Traffic, n.—"With traffic."—In the same direction as the direction trains run.

Trailing movement, n.—A train movement in the same direction as the switch or frog points.

Trailing point, n.—A switch or frog which points in the same direction as the movement of trains.

Train, n.
See (1) gravel train.
(2) stone train.
(3) swing train.
(4) work train.

Trams, n.—Live rollers for conveying ties and rails to the front of a track-laying machine.

Transfer slip, n.—A protected landing place for car floats, with adjustable apron for connecting the tracks of the pier and the car float.

Transfer tracks, n.—(a) Tracks used in conjunction by two railroads for the interchange of cars. (b) Tracks laid close together to facilitate the transfer of freight from one car to another.

Treated tie, n.—A track tie which has been subjected to a process for increasing its life.

Trimmed car, n.—A car loaded with rail and enough angle bars to build the whole into track.

Trunking, n.—A continuous wooden box for the protection of wires carrying electric current.

Trunk-line, n.—An ocean-to-ocean railway.

Turnout, n.—An arrangement by which a car may pass from one track to another. (Camp.)

Two level crossing, n.—A crossing in which the roads are at two different heights or elevations.

Unloading track, n.—A track from which cars are unloaded.

Vertical curve, n.—A curve used to connect intersecting grade lines.

Walker, n.—Same as "general foreman" or "walking boss."

Walking-boss, n.—Same as "walker" or "general foreman."

Wane tie, n.—A squared tie showing parts of the original surface of the tree on one or more corners.

Waste, n.—Material in excess of that required to make an embankment of given cross section.

Web, n.—"Web of rail."—The part of the rail between the ball and the base.

Weed-cutter, n.—A sharp spade-like tool with a long handle, for rooting up weeds.

Wheeler, n.—A dirt scraper mounted on wheels.

Whip, v. i.—"To whip a spike."—To draw a spike, when driving it, to a different vertical position from that in which it was set.

Whip guard signal, n.—A device for warning freight trainmen that they are approaching an overhead ridge. The signal consists of a series of heavy cords hung several inches apart and at a height such that the ends of the cords will strike a trainman who is standing on top of a moving freight car.

Wide gage, n.—(1) Uniform wider gage used on curves. (2) Gage of track where the rails have spread.

Wing, n.—The outside of a frog back of the point.

Wing rail, n.— The outside rail of a frog back of the point.

Work train, n.—A train engaged in construction or maintenance work.

Work ways, v. i.—A command to turn a rail ball up.

Work ways, adv.—The position of a rail which corresponds to its position when in track. Right side up.

Wye track, n.—Same as "Y-track."

Yard, n.—A system of tracks arranged in series, within defined limits, for separating and making up trains, storing cars, and other purposes.

Yard, n.—
(1) classification yard.
(2) cluster or general yard.
(3) departure or forwarding yard.
(4) distribution yard.
(5) freight yard.
(6) gravity yard.
(7) passenger yard.
(8) poleing yard.
(9) receiving yard.
(10) separating yard.
(11) storage yard.
(12) summit or hump yard.

Y track, n.—A triangular arrangement of tracks used in place of a turntable for turning engines, cars or trains; or for transferring a train from one to another of two intersecting tracks.

COMMITTEE MEMBERS, ROADMASTERS AND MAINTENANCE OF WAY ASSOCIATION.

Following are the names of newly appointed committee members of the Roadmasters and Maintenance of Way Association:

Foreign Labor.—Coleman King (N. Y. C. & H. R.); P. J. McAndrews (C. & N. W.); Geo. M. Greene (C. R. I. & P.); J. W. Fletcher, Jr. (Car. & N. W.); C. C. Johnston (L. & N. W.); A. B. Richards (L. E. & W.); B. A. West (A. T. & S. F.).

Stone Ballast from the Crusher to the Track.—Fred B. Adams (P. & R.); John D. Boland (U. P.); A. M. Clough (N. Y. C. & H. R.); Henry Kleine (C. & A.); D. Foley (M. C.); Wm. A. Brandt (C. & N. W.); Michael Deltgen (C. & N. W.).

How to Secure Foremen—Organization of Section—Length of Section.—P. M. Dinan (L. V.); L. A. Lewis (P. & R.); J. A. Roland (C. & N. W.); John Barth (C. C. C. & St L.); Carl Buhrer (L. S. & M. S.); J. P. Corcoran (C. & A.); T. F. Donahoe (B. & O.); J. E. Wilkinson (C. & N. W.); Bruce James (C. & E. I.).

Under What Department Should Construction Work Be Handled to Obtain Best and Most Economical Results?—M. Burke (C. M. & St. P.); T. H. Hickey (M. C.); James Sweeney (C. & E. I.); Thomas Thompson (A. T. & S. F.); A. E. Muchotte (C. R. I. & P.); M. Donahoe (C. & A.); Geo. Barnoske (C. M. & St. P.).

New and Improved Appliances.—W. E. Emery (P. & P. U.); J. E. McNeil (A. T. & S. F.); James Burke (Erie); J. S. McGuigan (St. L. S. W.); A. G. Hart (S. P.); W. R. Thompson (Cent. of Ga.); Wm. Shea (C. M. & St. P.).

Arrangements.—Geo. D. Gifford (N. Y. C. & H. R.); T. H. Hickey (M. C.); Abel Grills (G. T.); L. W. Hanselman (N. Y. C. & H. R.).

The reports of the above committees will be given at the next annual meeting. In addition to this a paper on Deterioration of Spikes and Angle Bars in Preserved Ties will be presented by W. M. Camp. Two topics are assigned for general discussion, viz.: Tie Plates vs. Rail Braces for Holding Track to Gage, and The Best Method of Inspecting Ties in Track for the Following Year.

MAINTENANCE OF ROADWAY AND TRACK.*

(Continued from Page 520, November Issue.)

Lining and Gaging.

Line and gage are as important as surface, and if they are not properly maintained the track will soon become unsafe. To do a perfect piece of track-lining requires considerable skill and only a very expert foreman possessing perfect sight can hope to properly line track by going over it once only. Where track is badly out of line over long stretches, center-stakes should be set as a guide, otherwise it will be a difficult matter to keep "swings" out of the track ("swings" are long stretches of track out of general line). In lining swings out of track the foreman should stand far enough from his men to get a general view of the track. After having roughly lined it in this manner to take out swings, he should then stand at a point about six or seven rail-lengths from his lining gang, so that he can see all short kinks in the line, can direct the men in their work and prevent the general line from being disturbed.

After track is lined it should be put in perfect gage. Two or three men can be employed at this work while the remainder of the gang are filling in the track and dressing the ballast. Track should be gaged by commencing on the side opposite the line-side; that is, one side of straight track should be considered fixed and left undisturbed while all spike pulling and redriving should be done along the opposite rail, which may for convenience be called the gage-side of the track. Beginning at the place where each day's work starts, place the gage on the track and make a test. If the gage is found correct make other tests every four or five feet until a joint out of gage is discovered. From this place continue the tests until another place in perfect gage is found. All spikes each side of the rail, between the two points in correct gage should then be pulled, and the intermediate portion thrown into gage. Before moving the rail, however, all spike holes must be plugged, and when spiking the rail the gage should be laid across the track close to the point where spikes are being driven while a sufficient number of men (two or three) hold the rail firmly up to gage. If the track is out of gage for any considerable distance the spiking should be kept up close and not over four or five ties should be left unspiked at one time, unless the gang is large enough to place flagmen in each direction to protect trains. A new gage, as well as an old one, should be tested by comparison with a standard steel tape which may be obtained from the supervisor. If found inaccurate the defective gage should be returned to the supervisor as defective material. When gaging track it is important to avoid placing the gage in such a position on the rails at joints as will permit the inner flange of the gage to rest against an angle-bar projecting beyond the ball of the rail. Such carelessness would result in track at joints being wider than standard gage.

As the general surfacing and lining of track progresses, all signs and fixed signals of the roadway, such as crossing signs, whistling posts, mile posts, etc., up to the point where the work for each day ends, should be placed in permanent repair. Cattle guards and crossings should be put in proper condition and right of way fences and snow fences repaired. Ballast should be dressed and the shoulder of the track formed to a standard line. Crossings should be made long enough to provide a safe and easy passage for any vehicle or harvesting machine that will be likely to use them. Where possible, the best material obtainable should be used for filling at crossings and the material should at all times be kept to the top of the rails.

By the time the foregoing maintenance duties have been completed, the spring and part or all of the summer months will have passed. Rail renewals may be made at any convenient time while the regular maintenance work is progressing. The track should be carefully inspected. Where a broken rail is found it should be replaced at once, provided this is possible; if not, it should be securely spiked at the break and the track protected by flagmen until the rail can be drilled and a pair of angle-bars bolted in place.

Arrangements should at once be made to replace the broken rail. Rail racks are placed on the side of the track, one near each mile post. These racks are placed there to hold rails at convenient points for replacing defective rails.

Whenever rails are to be changed, or the roadbed is to be raised at some point where wires run from the track to battery chutes or elays, or whenever ties are replaced for any work to be done around joints, switches, etc., extreme care must be used so that none of the track or bonding wires that form a part of the track circuit operating the block signals are broken. The insulated joints at the ends of blocks must be assembled and maintained in accordance with standard requirements.

Weber joints must be carefully adjusted and all bolts must be tightened fully before spiking, otherwise the joint will be drawn out of line if joint is first spiked and then the bolts fully tightened.

Owing to the need of insulating joints at the ends of blocks the bolts in the angle-bar connections at these places are not staggered. On all other joint connections they must be staggered. The necessity for this is apparent, as the effect of a derailment on the bolting of the joint, if bolts are not staggered, is to shear all the nuts off the bolts and permit the angle-bars to become disconnected from the rail.

Miscellaneous Maintenance Work.

The general maintenance work so far outlined is such as should receive the first and most thorough attention during the spring and early summer months. There is, however, much work connected with roadway and track which must be repeatedly done throughout the year. Broken bolts and rails are likely to be found at any time and must be constantly watched for and at once replaced. Loose nuts must be tightened; loose spikes must be drawn, the holes plugged, and the spikes redriven in the plug. Ties that are placed in the track as renewals must be retamped to secure a firm bearing for the track. Loose joints must be watched for and remedied. Low joints must be raised, for if allowed to remain they are very destructive to the general safety of the track. Bolts soon become broken in such joints unless the ties at these places are firmly tamped. All ties should be kept straight in the track and at right angles with the rails, especially at joints. The "creeping" of rails is a source of trouble in maintenance of track. It is especially difficult to contend with at switches and at a crossing of one railroad with another at grade; in the latter case the tracks of both roads are thrown out of line at the crossing. The creeping tendency is not always equal in both rails of the track, and on double track takes place only in the direction of traffic. On single track the creeping is most common on down grades and causes greatest trouble where two descending grades meet. Creeping of track is due to several causes. Where the conditions of roadbed and ballasting are as nearly perfect as can be, the continual wave-motion produced under traffic is the common cause. Soft, springy roadbed and poorly compacted ballast are contributing causes. Firm roadbed and solid ballasting prevent some of this tendency. Spiking joints in holes punched in the flanges of angle bars retards the creeping tendency. Anti-rail creepers secured to the rails and firmly resting against the ties are, at times, an additional help. On bridges, however, the joints must not be spiked in the holes of angle-bars, unless the joint ties are blocked between the ties at the joints and for at least two ties each side of joint.

Particular attention should be given to switches. Frogs

*From a bulletin of the Chicago Great Western R. R. containing portions of copyrighted Bulletins of the Union Pacific Ry.

should be kept tightly bolted at all times, and precautions taken so that none of the wires operating the track circuit of block signals are broken. The head blocks of switches must be kept firmly tamped and switch stands securely spiked to prevent the switch lights from being shaken out. Perfect surface must be maintained at switches and for a distance of 100 ft. in each direction; line and gage must be kept true and accurate; frogs, connecting rods and pins must be maintained in place and secure, and movable rails working freely and fully bolted, with all nuts tight. Proper attention should be given all these matters and such repairs made as are necessary to restore every part to standard condition.

Drainage.

The most important factor in the maintenance of good track is good drainage. Water is the worst enemy of track, and it should be the aim of every track foreman to get water off the roadbed as quickly as possible. Every hour spent in perfecting drainage facilities and keeping them in good order lessens the amount of repair work required to keep the roadway and track in proper condition. Ballast should be dressed to give a neat appearance to the roadway and to insure good drainage of the roadbed. There should be no irregularities of the surface which can collect and retain water. An open space should be left beneath the rails so that drainage will be uniform and free.

In deep cuts the slopes often wash badly and fill drainage ditches with such a quantity of soil that the most economical method of opening the ditches may be by means of a ditching machine. Embankments or fills also wash badly at times, or settle out of grade. Ditches in cuts must be kept clean and free from obstructions so as to thoroughly drain the roadbed. In cross section they should conform to standard drawings as far as possible. Material removed from ditches must be used whenever practicable to reinforce narrow embankments. Any surplus ballast should also be gathered when dressing track after ditching, and removed to some place where it can be used to advantage. No refuse should be thrown where it can be washed into ditches. Open passageways should be provided and maintained to drain water from all road crossings. All culverts and similar openings in the roadway for the passage of water must be kept free from driftwood or other obstuctions.

Should the general drainage of the ground be toward a cut or fill, surface ditches must be made outside the slopes and a sufficient "berm" (level) provided between the slope and the ditch to check the flow of wash. Ditches should be thoroughly cleaned out as early in the spring as possible and again late in the fall, and a growth of grass or similar vegetation should be encouraged on slopes as a preventive of excessive wash. On curves in cuts it is often necessary to conduct the water along the inside of the curve, to prevent washing of the roadbed. In such cases the outer ditch is dammed at intervals and a drain laid across (under) the track to lead the water to the inner ditch. Where the grade is such that the fall of ditches is rapid, it may be necessary to use rip-rap.

In the spring of the year the conditions of the cuts and fills can be accurately judged by the gradual seepage of water coming from them while the frost is leaving the ground. Observations carefully made at this time will furnish a correct guide for improvements in the drainage system of the track. Fills made of some materials may cause more or less trouble for a long time through constant settling. This is due to the water which drains through the ballast and is retained by the fill or embankment. In cases where frequent trouble of this kind is encountered, drainage may be improved by constructing a "blind" ditch in the side of the fill. This consists of a trench dug just beyond the ends of the ties extending from the face of the ballast to the outer edge of the fill or embankment. This ditch should be dug deep enough to extend to the bottom of the ballast under the track and should be filled with coarse stone. It should then be covered with a light dressing of earth so that it does not mar the appearance of the roadway. Such trenches may be placed at intervals of 50 ft. and will overcome most of the disturbance caused by the constant seepage of water into and throughout the fills. All places where trouble due to imperfect drainage is encountered should be carefully watched by the track foreman, and the supervisor should be consulted so that the best plan for correcting the trouble may be decided upon.

Special Work.

The maintenance of track on bridges and in tunnels is of a special nature. Bridge repairs should be made by bridge men or those who have charge of such work. Repair work in tunnels presents problems differing from those encountered on ordinary maintenance of track, and must always be done under more or less unfavorable conditions as compared with work in the open. Some tunnels are constantly wet, others dry, depending upon the nature of the formation through which they pass. In all wet tunnels ballasting should be done with broken stone, slag or similar materials. In dry tunnels gravel, cinders or almost any firm material makes good ballast, because the track is never exposed to water. Track in tunnels must not be raised unless special authority is given to do so. A certain overhead clearance is provided for in tunnels and raising track may reduce this to a dangerous minimum.

Weeds and grass grow rapidly on the track and right of way and cause much trouble, and it requires the expenditure of a great deal of labor to suppress their growth. Weeds growing on the track interfere with the work of maintenance as well as with the operation of trains. When crushed by the wheels of locomotives and trains they make the rails "greasy" and cause slipping. In addition to this they hide portions of the track to such an extent that many places out of repair and needing attention are liable to be overlooked. Weeds should either be cut, or burned with a weed-burner. This work should be done systematically by beginning at one end of the section and continuing throughout until all weeds have been destroyed and a uniform appearance given to the track and right of way. If this work is followed in a definite manner and at a definite time, the section can be gone over in a few days, leaving the men free to resume general repair work until such a time as the weeds or grass on the right of way must again be mowed or burned.

Where it is impossible to arrange for teams and machines to mow the right of way or where the country is too hilly for such a method, the section men should be put at the work of cutting the weeds and grass, and if necessary to complete the work in a relatively short time the supervisor may arrange for a few extra men to be assigned to sections where teams and machines cannot be used or obtained, to assist in mowing.

When the weeds and grass cut on the right of way are dry enough to be burned, fires should be started along the right of way fence, or at the fire guards (where such fire guards exist), at a time when there is no wind blowing or when it is blowing toward the track. Before starting fires all rubbish liable to communicate fire to bridges, culverts, telegraph poles, or tie piles should be cleaned away from such places or material. At the close of each day care should be taken to extinguish all fire.

In the fall of the year low places in the track, low joints and loose ties, etc., should be looked for, and when detected should be put in proper condition. If these things are attended to before freezing weather begins, a large amount of shimming will be avoided during the winter.

When any considerable quantity of rails and fittings are being taken from the track and replaced by new, all the old material should be neatly piled each day and not left lying

on the track where it may be covered by ballast; neither should it be thrown to one side on the right of way where it cannot be found. Where the quantity of material removed from the track warrants it, a work train will make such runs as are necessary to pick up old material.

Employes should at all times bear in mind that no material is to be wasted. New material must be properly used and cared for. Scrap and waste must be collected and taken to the section tool house at the close of each day. Old and new material must not be mixed, but must be carefully sorted and kept separately piled or in separate compartments where stored. Tools should be kept in good order, and all that were in use should be carefully collected after each day's work and returned to the tool house. Economy must be practiced in the use of all material as far as consistent with securing the best results. Many spikes are carelessly drawn and such spikes are often thrown in the scrap, when if a little care were used or a moment given to straightening them they would be rendered serviceable.

Serviceable bolts, washers, spikes, tie-plates and fastenings of every description must be removed from old material before piling it. Old ties removed from the track each day should be neatly piled for disposition, and all rubbish in the vicinity where gangs are working and which tends to accumulate on the right of way should be gathered and properly disposed of. Combustible materials, such as dried leaves, grass, weeds, etc., must be kept away from trestles, bridges and other structures to which fire could be communicated.

Storms—Emergency Work.

After a heavy snow storm the track should be shovel-flanged around stations, water tanks, and other stopping places, and at the foot of heavy grades to prevent the snow from forming ice on the rails and causing engines to slip when starting trains. This work should be done by shoveling the snow from the inside edge of the rails for a distance equal to the width of a shovel; all snow should be removed in this space down to the tops of the ties.

The overflow of water tanks, in freezing weather, will form ice extending to the top of the track, and if this is not picked out and shoveled away each day it will not only prevent engines from starting their trains, but may also cause derailments. In addition, track has a natural tendency to heave at these places, and as a preventive, the roadbed should be dug out to a point below frost line and filled in with coarse stone to within a few inches of the bottom of the ties. A light coat of ballast should then be placed on top of the stone to secure a uniform surface for the track.

During violent wind and rain storms the track should be patrolled both day and night, and all culverts, bridges and points where obstructions are likely to occur should be carefully watched and inspected. Track walkers should look for all defects in track such as broken rails, spreading and heaving of track, loose nuts, broken bolts, spikes, etc. They should observe telegraph lines, signals, and right of way fences, and report to the foreman any defects therein. When patrolling the track they should carry several spikes and track bolts, a spike maul and a wrench, two red flags by day or two red lanterns by night, two fuses and six torpedoes.

When track is unsafe or impassable, or before obstructing track or in any way rendering it impassable, a flagman with stop signals must be sent in both directions a sufficient distance to insure full protection. At a point not less than one-fourth of a mile from the point to be protected, he must place one torpedo on the rail and firmly fix a red flag across the center of the track. Continuing back one-half mile from the point to be protected, he must place two torpedoes on the rail two rail-lengths apart. He must then return to the single torpedo where he must remain until relieved by another flagman or until recalled by his foreman. When recalled by his foreman he will remove the single torpedo (and not before). During foggy or stormy weather in the vicinity of obscure curves or at descending grades, or when other conditions require it, the flagman will increase the distance. Should a train be seen or heard approaching before the flagman has reached the required distance, he must at once place one torpedo on the rail, and if at night or during a fog, display a red light. The greatest care must be exercised in protecting track if work must be done thereon during fog. Such work as it is practicable to postpone should be left until the fog lifts.

Station and Yard Work.

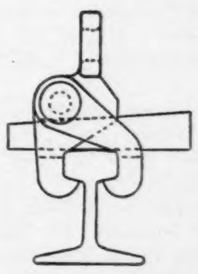
From half a day to a day each week should be devoted to cleaning up around stations, yards, and around section tool houses and similar quarters. This is essential for general sanitary reasons as well as for the sake of tidiness and appearances. It is especially desirable to have attractive grounds and pleasant surroundings at important stations and junctions where passengers are often compelled to change trains or stop over for connecting trains; and while it may be that at large stations regular forces will be detailed to keep station grounds in proper condition, it will often be part of the duty of section men to work in and about station grounds. Gravel or cinders, if used for the station platform, should be kept neatly leveled off, and all papers and other rubbish should be picked up so as to preserve a generally tidy appearance. Cleanliness and neatness displayed in the care of station buildings and grounds give travelers a favorable impression of the road, besides being of importance in other ways.

IMPROVED RAIL CLAMP.

A new rail clamp, invented by W. H. Bates, superintendent of steam shovel repairs, Panama Canal, after a six months' trial, has been adopted and 350 will be put into service.

The function of this clamp is to act as a "stop" when a shovel is moving forward, to prevent its running off the end of the track; also to "block" the truck wheels securely in place when the shovel is working.

The clamp used heretofore was attached to the rail by means of a key driven under the base of the rail, consequently it was necessary to place the clamp between ties. When



Rail Clamp Used on Panama Canal.

the track is in mud and water up to the rails the annoyance and delay incident to attaching the clamp are considerable; furthermore, the ties often interfere with locating the clamp where desired.

The new clamp is fastened to the rail by means of a tapered key of steel passing crosswise over the rail and thus permits the clamp to be set directly over a tie, or any place desired. The key being above the rail avoids the mud and water.

The principle on which the clamp works is similar to that of a pair of ice tongs. The clamp consists of two steel castings which form the hooks and body of the ice tongs as well as a convenient handle. These castings are fastened together by means of a heavy rivet which acts as a hinge pin. The hooks bear on the under side of the rail head when the wedge is driven above the rail, and below the hinge

pin; thus giving a secure grip on the rail. The cost of the new clamp is considerably less than that of the old style.

STRUCTURES.

The A. T. & S. F. System will probably set aside $250,000 in its next budget for improvements at San Bernardino. These will include a new $75,000 blacksmith shop.

A contract has been given by the Atchison, Topeka & Santa Fe to the Sharp-Fellows Company, Los Angeles, Cal., for erecting a concrete retaining wall at the bridge over the Mojave river near Victorville.

The Canadian Northern, according to reports, is planning the construction of an 11-span bridge near Montreal.

The Aurora, Elgin & Chicago has let the contract for building a one-story brick passenger station 35 ft. x 100 ft., at Wheaton, Ill., to cost about $25,000.

Plans for the construction of a concrete viaduct to be built by the Chicago, Milwaukee & Puget Sound over Denver, Perry, Hogan, Medelia and Helena Sts., Spokane, Wash., have been approved by the city engineer and the Board of Public Works.

The Illinois Central is reported to have about completed plans for the new Illinois Central, Rock Island and Frisco lines depot at Memphis, and it is believed that work on the station will be begun in a short time. The plans are reported to call for an expenditure of about $1,000,000.

The Delaware, Lackawanna & Western, is is said, is planning the construction of a new concrete viaduct over the Tunkhannock creek at Nicholson, Pa. The plans are for a structure 2,700 ft. long and 235 ft. above the creek. The piers will be 240 ft. from center to center.

Plans have ben completed for a $40,000 round house to be erected at Rossville, Ill., for the Elgin, Joliet & Eastern.

The Kansas City Terminal Co. has let the contract to the Missouri Valley Bridge & Iron Works, Leavenworth, Kan., for the construction of the foundation and piers for the proposed new Blue River bridge at Sheffield, Mo.

The New York Central is stated to be planning to drive work early next year on the clearing yards and repair shops at Miller, Ind. The plans call for trackage 4 miles in length and 1,000 ft. wide, with a capacity of 20,000 cars.

The Northern Pacific, it is said, has decided to rebuild the Grassy Point Bridge instead of making repairs as at first planned.

Among the improvements contemplated by the Queen & Crescent is the reconstruction of the Cincinnati Southern bridge over the Ohio River to carry the big Mallet and Pacific type locomotives.

An expenditure of $450,000 at York, Pa., is planned by the Pennsylvania. The company will build warehouses and construct a subway at the Northern Central passenger station.

Plans have been completed by the St. Louis, Iron Mountain & Southern for the construction of a new station at Conway, Ark., and the relocation of the freight station and yards at a point about a quarter of a mile south. A. W. Sullivan, St. Louis, Mo., is General Manager.

The St. Louis, Brownsville & Mexico has let the contract for building a freight house 240 ft. x 30 ft., to replace the structure recently destroyed by fire at Brownsville, Tex.

Bids are being received, by T. T. C. Gregory, President of the Sacramento-Woodland, Woodland, Cal., for the construction of a 10,000 ft. trestle in the Yolo basin.

The Southern Pacific will build a new station, it is said, at Charter Oak, Fla.

It has been announced by the Southern that plans are in the course of preparation for the construction of a new freight depot at Raleigh, N. C., and the rearrangement and improvement of team track facilities there.

The Spokane & Inland Empire has given a contract to J. R. Good & Co., for building a passenger station at Colfax, Wash.

The Lake Shore & Michigan Southern has started work on the erection of a new 30-stall roundhouse at the site of the old roundhouse at Englewood, Chicago. On account of the stringency of the Chicago smoke prevention laws, this roundhouse is to be provided with a smoke washing device.

The New York Central & Hudson River has been granted permission to abolish two freight yards and stations at Spuyten Duyvil, N. Y., upon the opening of a new yard with a greater capacity at Kingsbridge.

The Orangeburg Railway has work under way from Orangeburg, S. C., northwest to North, 17 miles.

The St. Louis & San Francisco and the Louisville & Nashville will build 120 miles of new line at an average cost of $35,000 a mile to complete connections over new joint routes, including a cut-off from Beaumont, Miss., to the Louisville & Nashville, just east of New Orleans, La.

The Chicago & Eastern Illinois is to build an extension to Paducah, Ky., when the new double-track bridge over the Ohio river at that place is completed.

The Tidewater & Southern has completed nearly all of the grading and track has been laid on two miles between Stockton, Cal., and Turlock. There will be two steel bridges of 120 ft. each, and two bridges of 150 ft. each; also a 4,000-ft. trestle.

The Western Maryland will probably finish work in December on the new line from Cumberland, Md., north to Connellsville, Pa., 87 miles, where connection is to be made with the Pittsburg & Lake Erie.

The Woodville Railroad is planning on an extension from Kakulla, Fla., south to Crawfordsville, 10 miles. Thomas M. Hall., president and general manager, Woodville, Fla.

Personals

J. A. Roland, roadmaster of the Chicago & Northwestern at Sioux City, Ia., has been appointed roadmaster at Missouri Valley, Ia. A. W. Allstrand, roadmaster at Carroll, Ia., has been transferred to Sioux City, Ia., to succeed Mr. Roland. L. Gilbert, section foreman at Sioux City, has been appointed roadmaster to succeed A. W. Allstrand.

D. C. King, roadmaster of the St. Louis, San Francisco & Texas, and the Fort Worth & Rio Grande at Brownwood, Tex., has been transferred to Fort Worth, Tex. He succeeds J. S. Beck, who has accepted service with the St. Louis Southwestern, with office at Dallas, Tex.

A. E. Hutchinson, general purchasing agent for the Oregon Short Line and the Southern Pacific lines east of Sparks, former office at Salt Lake City, has been appointed purchasing agent of the Southern Pacific, northern district, with office at Portland, Ore.

Ward Crosby, principal assistant engineer of the Carolina, Clinchfield & Ohio at Johnson City, Tenn., has been promoted to the position of chief engineer succeeding M. J. Caples, vice-president, general manager and chief engineer, who has accepted a position with the Chesapeake & Ohio.

George H. Ballyntine has been appointed division engineer of the Western Pacific, office at Elko, Nev., succeeding J. H. Knowles who has been promoted.

G. H. Robison, general storekeeper of the Oregon Short Line, with office at Pocatello, Ore., has been appointed assistant

general manager in charge of purchases and supplies, succeeding A. E. Hutchinson, resigned to accept service with the Southern Pacific. T. A. Martin succeeds Mr. Robison at Pocatello.

H. M. Church has been appointed engineer maintenance of way of the Baltimore & Ohio, with office at Wheeling, W. Va., to succeed J. A. Spielman, promoted.

W. S. Crites has received an appointment as division engineer, to succeed F. L. Burkhalter, promoted. The office is at Los Angeles, Cal.

H. S. Elliott, assistant engineer, of the Erie R. R. at Jersey City, N. J., has been appointed to succeed H. C. Landon, division engineer with office at Hornell, N. Y. Mr Landon has resigned to accept a position with another company

G. C. Millet has been appointed engineer of the Atchison, Topeka & Santa Fe Coast Lines at Los Angeles, Cal., to succeed R. J. Arey, resigned.

RAILWAY CONSTRUCTION.

The Albion & Charlotte, projecting a 24-mile line from Albion to Charlotte via Duck Lake and Brookfield, has completed surveys and will be ready to let construction contracts next spring. The company already has 21 miles of completed grade. P. A. Cortwright, Springport, Mich., chief engineer.

The Bayfield Transfer, which operates a line from Bayfield, Wis., via West End and Bayfield, to Red Cliff, about 18 miles, has projected an extension from Russells west to Superior, 50 miles.

The Bolivian Government has been authorized to call for tenders for the construction of a railroad 108 miles in length, from Quica in Argentina to Tarija in Bolivia.

It is reported, that the Boston & Maine has bought land at Lynn, Mass., to be used for four-tracking work, in connection with abolition of grade crossings.

The Bowling Green Northern is planning to begin construction work in the near future. About 90 per cent. of the 50-mile right-of-way has been secured. Malcolm H. Crump, chief engineer, Bowling Green.

The California-Western R. R. & Navigation Co. expects to have all of the work finished to complete a 40-mile line from Willits, Cal., which is on the Northwestern Pacific, to Fort Bragg, by January.

The Cincinnati, Hamilton & Dayton has prepared plans for an underground crossing in South Fremont. Work will not be started until spring.

The Denver & Intermountain, which operates a line from Denver, Colo., via Lakewood to Golden, 13 miles, is making plans to build an extension of 10 miles.

The Dodge City & Cimarron Valley has been incorporated in Kansas with $3,600,000 capital, to build a line from Dodge City, Kan., to Kolman, N. M.

Blakesley & Son, New Haven, Conn., and Birnie, Adams & Ruxton, of Springfield, Mass., have been awarded the contract for the construction of the Hampden R. R., a new line.

The Indian Creek Valley has projected an extension from Jones Mills, Pa., to Rockwood, 50 miles. S. M. Faust, chief engineer, Connellsville.

The Liberty-White has work under way on an extension from Kaigler, Miss., to Tylertown, 15 miles. W. M. White, president and general manager, McComb, Miss.

It is believed, as the result of a recent interview between a representative of the Misouri Pacific and the Board of Trade, McPherson, Kan., that the railroad is considering the construction of the proposed extension from McPherson to Marquette, a distance of 25 miles.

The Minneapolis, St. Paul & Sault Ste. Marie has work under way, building from Frederic, Wis., north 73 miles to Boylston, Wis., nine miles south of Superior. Track laying has been finished to Kingsdale, 43 miles. There will be a steel bridge 300 ft. long over the St. Croix river; with a 1,430-ft. trestle; a 1,600-ft. bridge over the Black river; a 1,440-ft. steel bridge over the Nemadji river, and a 75-ft. steel bridge, with a 1,590-ft. trestle over the Clam river.

It is expected that the Norfolk Southern will shortly announced its new financing plan which will provide for a large amount of construction work. This company is stated to have acquired the Raleigh & Southport, the Durham & Charlotte and the Aberdeen & Ashboro, as well as the charter for the Raleigh, Charlotte & Southern. An extension 110 miles from Raleigh to Concord is proposed.

The Oregon Trunk Line has been completed from Fallbridge, Washington, to Bend, Oregon, and freight and passenger service extended from Opal City to Bend.

It is reported that the necessary capital has ben secured by promoters of the Midland Pennsylvania for the construction of the projected line through the Lykens Valley from Millersburg in a northeasterly direction to Ashland, Schuylkill County.

Plans and surveys are being made for tremendous improvements of Pittsburg terminals by the Pennsylvania, and it is estimated that $50,000,000 will be expended. The plans call for the electrification of the main line between Pittsburg and Pitcairn. Subways will be built at many points, yards will be extended and electric locomotives and new rolling stock will be added.

Surveys have been completed for the new branch line of the Pontiac, Oxford & Northern, from Bad Axe to Shabbona and Wilmot, and it is believed that construction work will be started shortly. The Pontiac, Oxford & Northern is a Grand Trunk Line.

The Pennsylvania has let contracts for new construction work, including six miles of track elevation for six tracks, in place of the present four surface tracks, through Rahway, N. J., and Linden, which accomplishes the elimination of fourteen grade crossings. The elevation in the immediate vicinity of Rahway will be three miles long. A new station will be built in Rahway; it is to be of modern type with island platform. New stations will be built at Linden and Scott avenues. The work at Rahway and Linden will necessitate constructing an embankment of nearly 2,000,000 cu. yds. of earth, and will require approximately 130,000 cu. yds. of masonry. The bridges over the streets will consist of steel girders with solid reinforced concrete floors.

The Russellville, Dover & Northern, incorporated two weeks ago with a capital stock of $180,000, proposes the construction of a 10-mile steam line from Russellville to Dover in Pope County. The promoters hope to begin construction work by the first of next year.

It is reported that the Southern Pacific intends to construct and operate a branch from Marfa to Pecos, Texas. It is generally understood that the railroad is considering the purchase of the Pecos Valley Southern, a line running from Pecos to the Davis Mountains, a distance of about 20 miles, and then making an extension from Fort Davis to Marfa. At meetings recently held at Marfa and at Fort Davis, citizens secured a bonus of $100,000.

The Virginian Ry. has awarded a contract to W. W. Boxley & Co., Roanoke, Va., for lining with concrete 18 tunnels on its road in Virginia and West Virginia.

With The Manufacturers

OSCILLATING SWITCH.

We show herewith two illustrations of the Brown oscillating switch. The result aimed at in the design was to make the switch reasonably weatherproof—one that would operate under all conditions that trains can be operated, and also suitable for operation by automatic devices.

In place of the point used in the ordinary split switch is a cylinder which is carried on circular bearing seats and engages the side of the rail to which it is held. Grooves in the surface of the cylinder, one running lengthwise and one crossing the cylinder, engage the flange of the wheel and turn it to the siding, or to the main track; the desired groove is turned to position by revolving the cylinder on its axis one quarter of a turn.

The grooves are the only part open to the weather, and these are cleaned by the passing of wheel flanges through them, as the flange grooves of the surface car lines of our cities are cleaned.

Oscillating Switch Set for Main Line.

Oscillating Switch Set for Siding.

Anything to stop the operation of the switch must fall in the groove behind the last wheel of the last car, otherwise the flange will knock it out, and must be a certain size, neither too large nor small. Snow falling on the switch will fill the grooves to conform to a cylinder, and will rotate with the cylinder until a passing flange cleans it out.

In operating the switch no surfaces are closed together between which the falling of foreign substances can lodge to hinder the proper adjustment.

The movement of the cylinder can be controlled by any switch stand, but a special one has been designed which has several good features. It provides a lock which takes all strain from the stand, locking the cylinder (or the point if used in an ordinary split-switch) directly to the rail. If switch is not locked the target shows "stop" position. In operation the unlocking movement sets the target at "stop," where it remains until the switch is thrown and locked, when the target or semaphore controlling the track will clear.

A feature of the oscillating switch is that it does away with split points, which sometimes work loose and allow a sharp flange to force its way between the point and the rail, causing a derailment.

The oscillating switch described was designed by Woodmansee, Davidson & Sessions, Inc., consulting engineers, First National Bank Building, Chicago, under patents held by E. D. Brown, Kalispell, Mont.

ANTI-CREEPING TRACK CONSTRUCTION.

On all heavy trunk lines where the traffic on the rails is in one direction, considerable difficulty is experienced in keeping the track from creeping in the direction with the traffic. We describe herewith a means for effectually supporting the rail and at the same time eliminating the creeping of the track and the disadvantages incident thereto.

The structure includes a tie plate having a roughened under surface adapted to bear against the upper surface of the tie, the plate being provided with a flange adapted to bear upon the upper surface of the base flange of the rail. The plate and rail are also provided with serrations or notches which extend transversely to the rail where they come in contact. The notches of the plate engage with those of the rail, and the two are held closely together by driving the plate under the rail, thereby securing a wedge between the flange of the plate and the rail flange.

The rail cannot creep longitudinally for the reason that the notches at the under side of the base flange engage the notches in the rail. The tendency of the rails to tilt or cant is resisted by the plate and the inside spikes for the plate. The ribs on the under side of the plate imbed themselves into the wood of the tie, and resist movement between the tie and the tie plate. The tendency of the track to creep would be practically eliminated, as it would be resisted by every tie.

Another advantage of such a construction is that ties would not slew around out of square, as they frequently do when the spikes are loose, even on tracks which are not creeping.

H. E. Haight, Marshfield, Wis., is the inventor, and holds the patent on the tie plate and anti-creeper described above.

The Pennsylvania R. R. provides its employees with numerous educational advantages. One of the latest additions to its facilities is a train lighting instruction car. The apparatus installed in the car consists of a 32-cell storage battery, a turbo-generator, a variable speed motor with necessary controlling apparatus for driving the axle devices, and a number of axle generators with their regulating equipments. One end of the car has been partitioned off and equipped as an office and sleeping quarters for the instructor.

The car is to go to various points along the line and employees engaged in electrical work are to be given lectures and instruction in the care and use of electrical apparatus.

HEADLESS

RAILWAY ENGINEERING AND MAINTENANCE OF WAY.

Industrial Notes

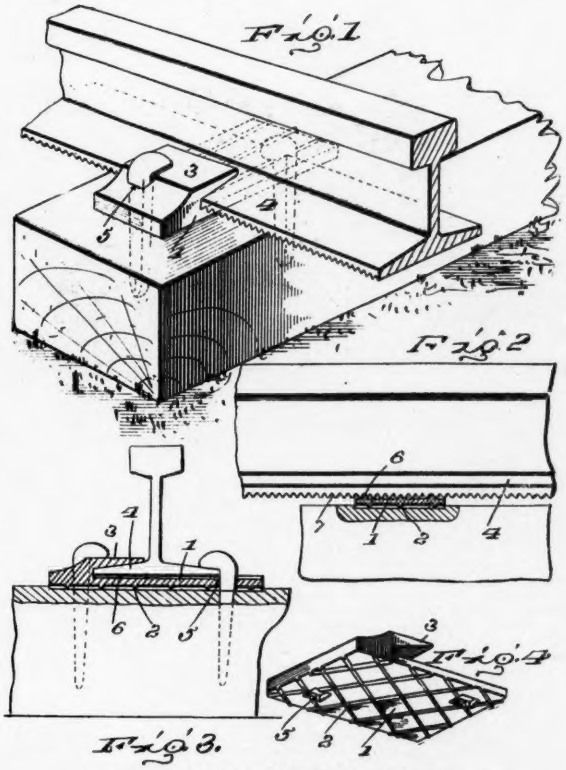
The Commercial Construction Co., Sudbury, Ont., has been incorporated to carry on a bridge-building business, capital, $40,000.

Mr. Frederick P. Cook, former secretary of the Milwaukee Locomotive Manufacturing Co., Milwaukee, Wis., has been placed in charge of the New York office of the company, at 111 Broadway.

The Chicago Pneumatic Tool Co., Cleveland, O., has given the contract for the construction of a factory on East Forty-ninth street, near Lakewood avenue, to Edward A. Weiland.

The F. M. De Weese Co., through their Chicago agent, Crerar, Adams & Co., has furnished the Government at the Panama Canal with a number of their No. 5 and No. 7 Mosher Jacks. The Mississippi River Commission has ordered twelve No. O Mosher Jacks, and a large quantity of repair parts on jacks already in use.

Hubbard & Co., Pittsburg, Pa., manufacturers of shovels, spades, scoops and other railway tools, will erect a machine shop, 99 x 200 ft. in area.



Details of Anti-Creeping Track Construction.

The Bucyrus Company, Milwaukee, Wis., has recently been reorganized under a plan by which its authorized capital stock has been increased to $10,000,000. This action was taken so that some necessary additions to the plant and equipment could be made.

The United States Electric Company has delivered to the Chicago, Rock Island & Pacific the dispatchers and station equipments for a circuit of 30 telephone train dispatching stations. The Gill selector box outfits at the several stations are of the latest improved pattern, including the double time wheel two-figure combination selector with bell rung by the main line current and the dispatcher's outfit includes the two-figure silent keys. To the Gulf, Colorado and Santa Fe the company has delivered twelve station selector outfits for telephone train dispatching with the local bell circuit, the dispatcher's apparatus equipment having provision for extension of the circuit to 24 stations.

J. P. Coleman, chief engineer of the Union Switch & Signal Company, Swissvale, Pa., has been appointed consulting engineer of that company. L. F. Howard has been made engineering manager of the company, and F. B. Corey has resigned from his position with the General Electric Company, Schenectady, N. Y., to become engineer in charge of inspection of the Union Company.

The Pennsylvania Tank Car Company, Sharon, Pa., has been formed with $50,000 capital to make, rebuild and repair tank cars. G. F. Wood-Smith, Frick building, Pittsburg, is president and general manager. It is expected that the construction of the plant will soon be under way.

The Continuous Frog & Crossing Co. has been formed in St. Louis, Mo., to manufacture and distribute a newly invented manganese steel frog which is said to have been undergoing tests on several railroads. It is stated that the new device presents a continuous rail and therefore the shock of crossings, etc., is eliminated. The organizers are: W. J. Holbrook, H. F. Roach, G. F. Tower, Jr., W. G. Brown, and others.

Samuel Cabot, Inc., Boston, Mass., it is reported, will establish a plant in Harriman, Tenn., for the creosoting of railroad ties and other timber products.

The Indiana County Street Ry., Indiana, Pa., is enlarging its power plant by installing 625 kva. additional capacity. The company has placed an order with the Westinghouse Machine Co. for installing in its plant at Two Lick, Pa., one 625 kva. Westinghouse-Parsons turbo-generator unit and one No. 5 Westinghouse-LeBlanc condenser. The outfit will be used to supplement the present station which consists of a 1,000 kva. Allis-Chalmers turbine and Phoenix engine. The turbo unit will feed into the 6,600 volt, three-phase 60 cycle lines which the company is operating at the present time.

The Upton Machine Co., Benton, Harbor, Mich., has filed articles of incorporation. Capital, $30,000.

George Franklin Pond has been made manager of the Philadelphia, Pa., territory of the Wheeler Condenser & Engineering Company, Carteret, N. J., with office in Philadelphia. Walter G. Stephan has been made manager of the Cleveland, Ohio, territory of the same company, with office in Cleveland.

The Detroit Insulated Wire Co. has let contracts for the construction work on its new one-story brick factory on Wesson avenue, Detroit, Mich.

The U. S. Metal & Manufacturing Company, New York, has recently taken over the general sales agency in the United States for Texoderm, a material used for coach seat upholstering, made by the Sillcocks-Miller Company, South Orange, N. J. This company has also taken over the selling agency, in the southern and middle western states, for gears and pinions made by the Tool Steel Gear & Pinion Company, Cincinnati, Ohio.

The United States Positive Brake Co. has been incorported in Delaware by George G. Stiegler, Wm. M. Lupton, and Geo. D. Hopkins, all of Wilmington. Capital, $1,000,000.

The American Blower Company, Detroit, Mich., has filed an application for a charter for the Canadian Sirocco Company, Windsor, Ont. This company has acquired about four and one-half acres, and will proceed at once with the construction of the erecting shop, 50 ft. x 200 ft., steel and concrete construction; also the office building. The foundry building will probably be started in the spring. This company will hold the exclusive patent rights for the manufacture in Canada of Sirocco fans and blowers. The Canadian Sirocco Company will also make the full line of the American Blower Company's products, consisting of fans, blowers, heating, ventilating, drying apparatus, steam engines, steam traps, etc.

Recent Engineering and Maintenance of Way Patents

COMPOSITE RAILWAY TIE.

1,008,829—John H. Killinger, Colebrook, Pa.

This tie is composed of concrete rail supporting blocks connected by a tubular rod in two sections having flattened ends anchored within the blocks. The rods are bolted to each other at their meeting point in the center of the track.

RAIL FASTENING DEVICE.

1,009,007—H. E. Zimmerman, Hartstown, Pa.

The combination with a rail of a tie upon which the rail is mounted, the tie being provivded in its upper side with openings registering with the opposite edges of the base of the rail and extending transversely thereof; means for securing the rail to the tie, comprising angular securing members having substantially inverted T-formed lower ends, and laterally projecting heads at their upper ends adapted to engage against the upper side of the base of the rail, the lower ends of the engaging members being adapted, when the upper ends thereof are in inoperative position, to be inserted into the openings, and, when the upper ends of the members are turned to engaging positions, to engage against the under side of the portions of the tie engaged by the securing members; wedge members are arranged in the openings outward of the securing members for holding the latter in operative position; teeth on the outer edge of each of wedge member are adapted to engage against the adjacent side of the opening to prevent accidental displacement of wedge members; and means are arranged on the tie to prevent upward movement of the wedges.

RAILWAY ROADBED AND TRACK CONSTRUCTION.

1,009,020—J. N. D. Brown, Anadarko, Okla.

A railway roadbed, track and rail construction in combination with concrete rail bases reinforced lineally by parallel steel reinforcing bars wired to short lateral reinforcing bars placed near the bottom of the concrete rail bases and also reinforced by conduits placed near the top and outside of the bases.

SPLICE BAR FOR RAILS.

1,009,026—W. P. Thomson, Philadelphia, Pa.

A splice bar for rails having portions to extend under and form seats for the rail bases and a central portion at the mid-section of the bar, located at a distance from the rail bases for the entire width of said central portion and forming a deep section extending downwardly and inwardly from the outer edges of the rail bases to the lowermost portion of the bar.

APPARATUS FOR DISTRIBUTING CONCRETE.

1,009,117—F. E. Walters, Toledo, O.

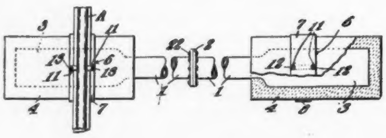
An apparatus for distributing concrete consisting of a derrick mounted for rotary movements, a boom vertically shiftable on the derrick, a conveyor extending from the boom and revolubly adjustable relative thereto, and means for conveying matter longitudinally of the boom to the conveyor.

RAIL BOND.

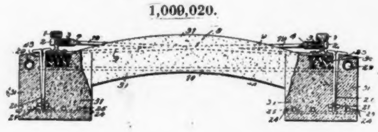
1,009,166—Humphreys Milliken, New York.

A rail bond consisting of thin, flat, flexible terminals and a relatively thin and flat body portion of substantially the same width and thickness as the horizontal cross section of the terminals.

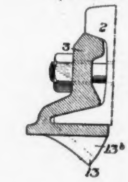
1,008,829.



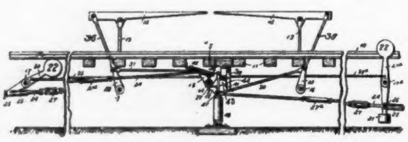
1,009,020.



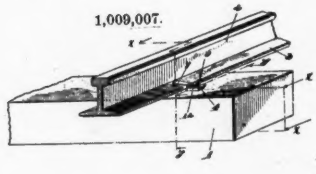
1,009,026.



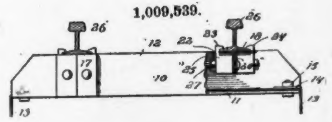
1,009,222.



1,009,007.



1,009,539.



AUTOMATIC CROSSING GATE.

1,009,222—Peter Castelli, Carney, Pa.

A device for automatically raising and lowering the gates at a railroad crossing, comprising mast gates pivotally mounted above the surface of the ground, means whereby yielding pressure is exerted to hold the gates in raised position and means whereby an approaching train lowers the gates, and locks them in their lowered position while a train is passing; locking mechanism is released when a train has passed. Means are also provided for cushioning the impact of the train on the machinery of the device.

RAIL JOINT.

1,009,250—C. L. Christofferson, Spearfish, S. D.

In a rail joint, the combination with companion rail sections formed in their meeting ends with seating recesses, of a member received in the recesses and spanning the joint, and a longitudinal series of anti-friction bearings mounted on the member and disposed at the tread surface of the rail, the walls of the recesses being undercut in proximity to the ends of the series of anti-friction bearings.

RAILWAY CATTLE GUARD.

1,009,404—Wm. Gebhart, Piedmont, Cal.

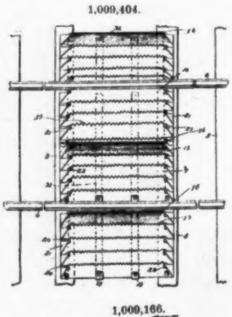
A cattle guard comprising a number of inclined blades having their upper ends connected and their lower ends spaced apart to form intermediate pockets, the opposite ends of the blades being beveled; end plates are provided bearing against the beveled ends of the blades and forming closures for the pockets, the end plates being provided with oppositely disposed attaching fingers for engagement with the adjacent inclined blades.

RAILWAY TIE.

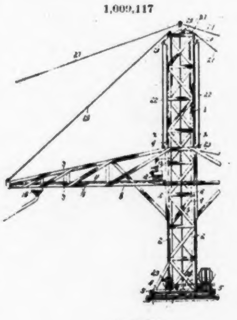
1,009,539—A. E. Marshall, Lima, O.

A railroad tie comprising a channel having a corrugated bottom, pairs of connected rail plates extending transversely to the channel and secured thereto, end plates secured to the channel and depending therefrom at the ends thereof and securing plates disposed in indentations formed in the rail plates, the upper ends of the securing plates being connected to the pairs of rail plates and adapted to engage the rails.

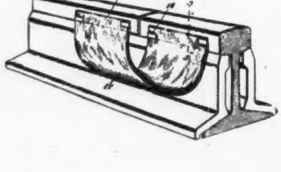
1,009,404.



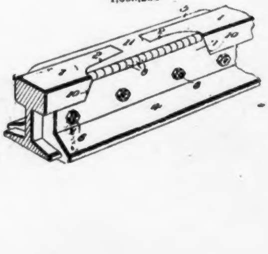
1,009,117



1,009,166.



1,009,250



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